ANNUAL RATES OF SUBSCRIPTION.

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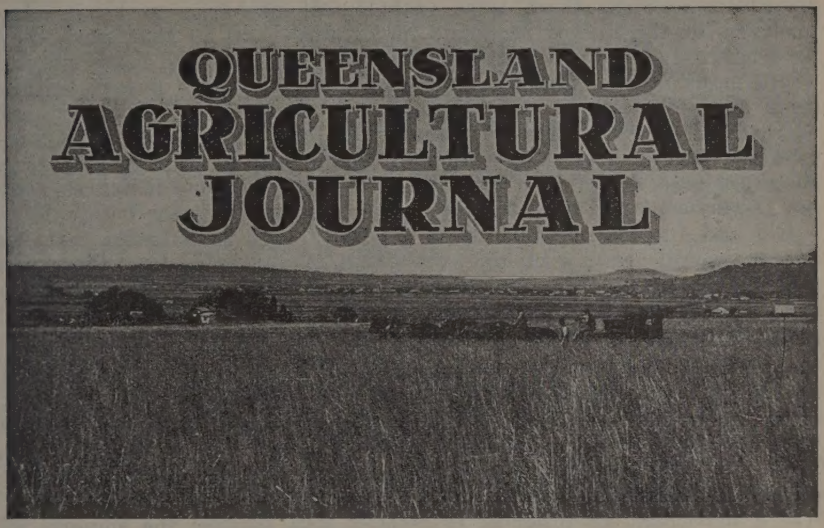

VOL XLIII. 1 MARCH, 1935. PART 3

Event and Comment.

Minister's Talk to Dairy Leaders.

"MY experience has been that we have achieved more by taking the farmers into our confidence, by showing them the road we are trying to tread, by inviting their co-operation and assistance in co-ordinating the activities of the Department with those of rural industry. Generally speaking, we wish to link up the work done on the farm, at the factory, and within the Department of Agriculture and Stock." With those remarks, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, prefaced a very interesting address to dairy leaders of several local producers' associations who, at the invitation of his Department, had assembled in Brisbane last month to undergo a brief course of instruction in departmental activities, in relation to the dairying industry particularly.

Continuing, Mr. Bulcock said that in the course of their visit to the several branches of his Department the dairy leaders would be afforded every opportunity of meeting his technical officers, and of seeing many things of interest and of great importance to their industry. Departmental officers, as employees of the State, would give them every facility for observing something of the work of the Department and answer every reasonable inquiry. Although everything at present possible to assist or direct the dairying industry was being done, he would welcome any suggestions for improving the position and conditions of the industry the dairy leaders might be prepared to submit. There were

some things, of course, entirely within the control of the dairy farmers themselves, especially in respect of hygiene and sanitation, and those things he commended for their attention as members of local producers' associations. Then there were pathological problems to be faced—problems of the utmost economic importance—and in that work they were assured of the practical assistance of veterinary and other officers. While many farmers might be prepared to do everything possible within their means to combat stock diseases, the checking or eradication of those diseases was obviously a matter for community rather than individual effort. The co-operation of every unit in the industry was therefore most desirable. It had been thought, in some instances, that his Department had been too rigorous in its campaign for better dairy cattle and for improved methods generally, but he believed that his hearers would agree with him—privately, at any rate—that there was a tremendous amount of avoidable economic loss in the dairying industry. It was their business, as far as practicable, to assist in the prevention of a continuance of that loss.

As an example of the necessity for full co-operation of all engaged in the industry, whether as producers or technologists, Mr. Bulcock cited the case of Denmark. That country, he said, delivered 136,000 tons of butter on to the British market every year, although it was Britain's tenth best customer, while Australia was Britain's third best customer for manufactured goods. In face of that fact, however, there was a movement in progress to restrict still further the imports of Australian dairy produce into Great Britain. There was every reason to feel concerned, he said, with the effect on Dominion trade of the seven or eight trade treaties entered into by Great Britain since the Imperial Conference at Ottawa with certain European countries, and which involved trade concessions to them on the British market. Apparently Denmark, to mention one of those countries, realised that next year when the existing treaty terminated the whole question of Britain's imports would be reviewed, and so was busy culling out her dairy herds with the object of achieving the highest degree of economy possible in dairy production. In the near future, therefore, Danish exporters would be able to tell the British consumer that they were in a position to offer butter with a guarantee that it was the product of disease-free cows bred, fed, and housed under the most hygienic conditions. In Mr. Bulcock's opinion, it was one of the cleverest forms of trade propaganda, based on a determined clean-up campaign in the Danish dairying industry, that had come under his notice. To the Australian producer the moral was obvious. Brains had to be met with brains, and the only effective reply to a trade competitor was the supply of an equal or better quality product.

Work of the Animal Health Station.

CONTINUING, Mr. Bulcock said that his Department was persisting in its efforts in the direction of the eradication, or at least control, of stock diseases within the State. Until recent years, the Animal Health Station at Yeerongpilly had been merely a place for the preparation of vaccines, toxins, and anti-toxins, and the treatment of redwater in cattle. It seemed to him when he assumed office that the station could be made of much greater service to stockowners, and to that end the work of the station had been reorganised and extended. A veterinary staff had been appointed and modern equipment provided. A system of refresher courses in animal husbandry for the field staff of the Dairy Branch had been instituted, so that the most recent knowledge in dairy

science might be made available to the farmer through the instructional and inspectional services. A disease-free herd campaign had been inaugurated, which, through the co-operation of the dairy farmers, had already produced sound results. The general veterinary staff of the Department had been greatly strengthened and, with the assistance of the farmers, they should be able to build up a system of dairy practice in Queensland which they could all regard with very great pride. In its relation to an industry of first importance in the economy of this country, every effort that had been made and planned, based as it was on modern dairy science and practice, had been well worth while.

High Quality in Dairy Products Demanded.

DISCUSSING the needs of the export market, Mr. Bulcock said that the Government had in view the establishment of a dairy laboratory to serve the needs of the industry. In that laboratory would be installed the most modern equipment. It was regarded as sound economy to extend scientific research in relation to such an important Queensland industry. No single unit of the industry, however, could alone solve its problems of either production or marketing; the co-operation of all—the Department, the factory, and the farm—was essential. After all, it was the producer who formed the foundation of any industry, and all the organisation and all the planned schemes would be useless without the co-operation of the people who were primarily concerned. That was why he had invited leaders of the dairying industry to visit his department and see for themselves what was being done for the men on the land, and so appreciate the call for the farmers' earnest co-operation. With animal-disease control, the production of the highest quality butter and cheese, co-ordination among every section and the co-operation of the producer, they would have nothing whatever to fear in the future of the dairying industry in Queensland.

Selling our Scenery.

EVERY district has some natural feature or some charm of landscape that would attract visitors from other parts of the State, and also from other parts of the Commonwealth, if they knew anything about it. So the question presents itself—a question well worth consideration by every local association—why not sell our scenery? Local patriotism—not to be confounded, of course, with narrow provincialism—can be a very fine thing and, rightly expressed with befitting enterprise, can have a definite material value. Tasmania, for instance, is said to derive more than a millions pounds in money every year from her tourist trade. The result is that the Tasmanian is definitely tourist-minded. He "boosts" his State wherever he goes, while the home-staying Apple Islander has developed a natural courtesy and kindliness that the stranger within his gates remembers long after the landscape delights of a beautiful country have become blurred through their mergence with later memories. According to the Canadian Bureau of Statistics, in 1929 tourists spent in the Dominion no less than £61,875,000. That enormous sum, however, shrunk during lean years to £22,000,000 in 1933. Of the Canadian tourist traffic the Bureau says: "Of all our export commodities only wheat and paper rank with it in importance," and since the fall in price of those commodities "it has surpassed both." Plainly, then, a country blessed with all the natural advantages—some of them unique—which Queensland possesses is blind to its own interests if it does not do everything in its power to attract visitors.

Root Knot Nematode and its Control.

By ROBERT VEITCH, B.Sc.Agr., B.Sc.For., F.R.E.S., Chief Entomologist.

CERTAIN species of nematodes or eelworms attack living plant tissue, some are parasitic on animals, while others are predaceous on nematodes themselves. The species of outstanding importance in Queensland is the common root knot nematode, so called because of the characteristic swellings produced on the roots of infested plants. This species reaches its maximum abundance in light sandy soils in the warmer portions of the State, heavy soils being much less favourable to its development, while soils that are either generally very wet or abnormally dry are usually lightly infested. Many important economic plants are susceptible to attack, but most grasses, maize, wheat, barley, broom millet, sorghum, peanuts, velvet beans, and certain varieties of cowpeas are either immune to attack or the infestation thereof is so slight as to be of no consequence. Heavy infestation in highly susceptible plants produces a marked dwarfing as a result of the disorganisation of the normal functions of the root system. Furthermore, such plants are decidedly less healthy in appearance than unifested plants; they wilt readily during hot dry weather, and generally the duration of their productive life is greatly curtailed.

Life History and Habits.

The female nematode assumes a pear-shaped appearance when full grown and then measures one-thirtieth of an inch in breadth, but the male nematode retains its worm-like appearance throughout life. The extremely minute eggs, of which as many as 500 may be laid by a single female, have a very tough shell which assists survival should adverse conditions prevail in the soil. The small thread-like nematodes emerge from these eggs at the end of the usual incubation period, and move about the soil in search of suitable host plants. These having been located the nematodes select young feeding roots and enter them generally near the tips. Feeding proceeds within the root tissue, and as a reaction to the infestation of the roots the very characteristic galls are produced. Swollen malformed areas occur throughout the root system of infested plants (Plate 107, figs. 1 and 3), and the swellings may either occur singly and only here and there on the roots or, on the other hand, the infestation may be of such intensity as to give practically the whole root system a swollen appearance, some roots bearing a marked resemblance to a chain of beads. Infestation is not always confined to the root system, for in the case of potatoes the tubers may be badly attacked, the surface thereof bearing a number of swellings (Plate 107, fig. 2) which impart a distinctly pimply appearance to the potatoes.

Other swellings may occur on the roots of plants belonging to the pea and bean family, but these are quite different in origin, being the beneficial bacterial nodules (Plate 107, fig. 4) characteristic of that group of plants. They are usually spherical in shape and small or moderate in size and can generally be easily detached from the sides of the roots on which they have developed. The nematode root galls cannot be so removed and are, of course, wholly undesirable. Both bacterial nodules and nematode root galls may occur on the roots of members of the pea and bean family.

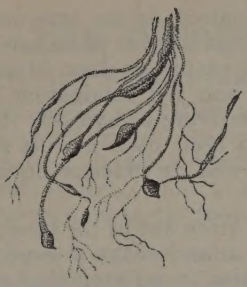

Fig. 1.

Fig 2

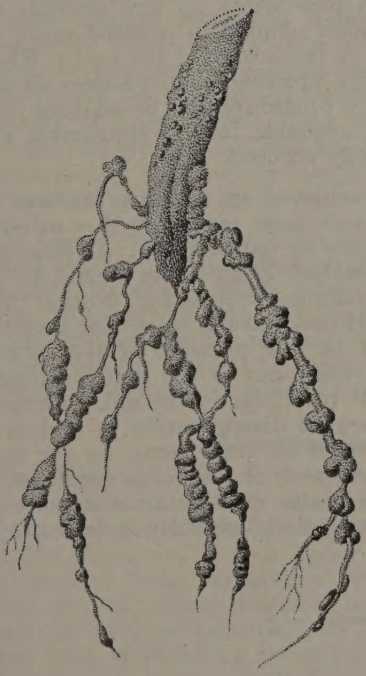

Fig. 3.

Fig. 4.

I W. Helmsing 1927.

Plate 107.—Root Knot Nematode.

Fig. 1.—Nematode galls on Strawberry roots.
Fig. 2.—Nematode-infested Potato.
Fig. 3.—Tomato root infested by Nematodes.
Fig. 4.—Bacterial Nodules on roots of Lupin.
(All half natural size.)

Control.

The control of the root knot nematode is an extremely difficult matter, because for the greater part of its life the nematode is securely entrenched within the tissue of its host plant. It does, of course, occur in the soil apart from the root tissue, and soil fumigation can dispose of large numbers of the temporarily free living nematodes. So far, however, no system of soil fumigation has been used in this State which would be economically practicable, as well as effective on an ordinary field scale.

Treatment of infested plants being quite out of the question, control should aim at maintaining such plants in as healthy a condition as possible, at reducing the nematode population in infested land and keeping uninfested country free from this serious pest. Thorough cultivation and heavy manuring frequently enable infested plants to produce quite a satisfactory crop, particularly if it is a rapidly maturing one, such as tobacco. However, plants that have been infested in the seed-bed do not generally respond to such treatment, and such seedlings are better discarded and destroyed, transplanting being restricted to plants showing no outward sign of infestation. Seed-beds in districts known to be infested are best established, when practicable, on new ground, and a further seed-bed precaution sometimes adopted in infested areas is the steam sterilization of the soil prior to the sowing of the seed. When an infested crop has been harvested the uprooted crop residues should be destroyed by burning where such a procedure can be adopted, for by doing so the nematode population available for the infestation of the succeeding crop should be appreciably reduced.

A further reduction may be achieved by rotating immune crops with susceptible crops, but the farmer must remember that infestation will inevitably recur, eradication being an impossibility. In cases where susceptible land is free from infestation every effort should be made to keep it so, and, if possible, any seedlings required for planting thereon should be grown on the property. If they have to be obtained elsewhere they should be carefully examined for the presence of the eelworms, and if infestation is present it is wiser not to use such seedlings on clean properties. Nematodes do not travel far in the soil, moving only a few feet each year, hence their rapid dissemination to and in new areas is due to their being transported on implements, on the feet of workers and stock, in running water, and, of course, in seedlings, seed potatoes, or nursery stock. These modes of dissemination should be kept in mind when an effort is being made to maintain a clean property free from infestation.

SHEEP-DRENCHING AIDS.

If you don't want your fingers chewed when dosing the sheep here is a simple preventive. Get a piece of No. 8 wire and bend it into the form of a hairpin 9 inches long and 1½ inches wide at the bow end. With the sheep held by your knees insert the bow between the sheep's lips, and bring it down over the tongue behind the front teeth. Then with the right hand lift its upper jaw, and the man with the squirt, or the capsule, will have no difficulty in placing the dose well behind the root of the tongue.

The Bronze Orange Bug.

By W. A. T. SUMMERVILLE, M.Sc., Assistant Entomologist.

THE bronze orange bug, *Rhœcocoris sulciventris* Stål, was recorded as a Queensland insect in 1868, and for almost fifty years it has been known as a pest of citrus in this State. Formerly the insect was named *Oncoscelis sulciventris*, and a good deal of what has been written regarding the pest is to be found under that name.

The vernacular name, bronze orange bug, is almost universally used in those Queensland citrus districts where the pest occurs. In some publications the name orange tree bug is used, but this is unsuitable, as it fails to distinguish the species from several others found on the same host.

Distribution.

The distribution of the insect is obviously controlled largely by climatic influences. The species is found in northern New South Wales, and extends into Queensland as far as the Gympie district, but north of Gympie tropical conditions become more marked and the insect does not occur there. In the same way more than about 60 miles from the coast the bug quickly becomes rare and is heard of as a pest only in cooler parts, such as on the Great Dividing Range, particularly in the vicinity of Toowoomba. Even within the small section of south-eastern Queensland just outlined the bug is a major pest only in places of comparatively low average temperatures, notably on the Blackall Range and at Tamborine Mountain.

The bug is easily transported in the second nymphal stage. It is a common practice for pineapple growers to pack their fruit in grasses such as Red Natal and Blady taken from under or near citrus trees, and quite frequently second stage nymphs are found crawling amongst this grass, and no doubt many are transported about the State in this way. However, the climatic barrier appears to be insuperable, and there is no reason to fear any extension of the area of distribution of the pest.

Economic Importance.

Within the area in which it occurs the insect is responsible for heavy damage to individual orchards in every part, but in only two large districts, the Blackall Range from Montville to Mapleton and Tamborine Mountain, is it a major pest of every orchard. It is a general pest of lesser importance in the vicinity of Palmwoods and Nambour, and to a lesser extent in the Redland Bay district. The bug is essentially a pest of vigorous trees, and in the two districts mentioned as being most troubled by it only orchards in poor condition escape severe depredation unless control measures be adopted.

It is difficult to assess the damage attributed to the pest, as the indirect loss of fruit cannot be calculated with any degree of accuracy. The ill-effects may be described as cumulative, for not only is young fruit removed but the wood which is to bear the following crop is reduced or even eliminated. Further, after a few years of heavy infestation the trees produce little growth and become harsh and incapable of carrying a crop. From a comparison of the yield of infested trees with what might reasonably be expected, it is considered that 20 per

cent. loss is about the average for badly infested orchards, and 30 per cent. loss by no means uncommon. Habitually infested orchards soon become uncommercial.

Host Plants and Varietal Preference.

The bronze orange bug is found on all varieties of citrus grown commercially in the districts concerned. Oranges appear to be preferred to lemons, or mandarins with the possible exception of the Fewtrell Early variety. However, the presence of young soft growth is all that is necessary to make any variety acceptable to the pest.

In addition to cultivated varieties the bug feeds and breeds on *Citrus australis,* the native orange, or wild lime as it is sometimes called. However, the numbers to be found on the indigenous host are very small. A few score individuals on this tree constitutes a large population, whilst 2,000 bugs on one orchard tree is common, and on many occasions more than 5,000 individuals have been taken from one orange tree. Further, *Citrus australis,* though not uncommon, does not occur in very large numbers. Migration certainly does take place from the native host to orchard trees, but the number of bugs so arriving in the orchard is certainly insignificant compared with the number bred in the orchard. It has been noticed repeatedly that after a determined clean-up on the part of a section of orchardists it is several years before the bugs again assume major pest proportions in the immediate vicinity. This would not be expected if migration were a major factor.

Adults, eggs, and first and second stage nymphs are sometimes observed on other plants growing in close proximity to citrus trees, but all the evidence shows that none of these other plants serve as hosts on which the insect can feed.

Description.

The bronze orange bug, in common with other members of the group of insects to which it belongs, namely the Heteroptera, has a life cycle consisting of seven stages—the egg, five nymphal instars, and the adult. Growth takes place by a series of moults, the old skin being cast off and its place taken by a new one, often differing considerably in colour and other characteristics.

The Egg.

The eggs (Plate 108, fig. 1) are laid on the leaves as a general rule; but occasionally batches may be found on fruits or, as has been mentioned, on other nearby plants. Both surfaces of the leaves are used as oviposition sites. The eggs are laid in batches of fourteen in a characteristic formation. Each batch is laid in four lines, the two outside rows having three eggs each and the two inside ones four each. Occasionally incomplete batches are found, but these are due no doubt to the female having been disturbed during oviposition. So far as has been observed no more than fourteen eggs are ever placed in one batch. The eggs are fixed to the surface by a fluid which covers them when they are laid. Commonly the egg shells remain attached to the leaf for many weeks, or even months, after hatching has taken place.

The eggs are spherical in shape, shiny and light green to almost yellow in colour. They are relatively large, being little less than one-eighth of an inch in diameter. Several batches may be found on one leaf.

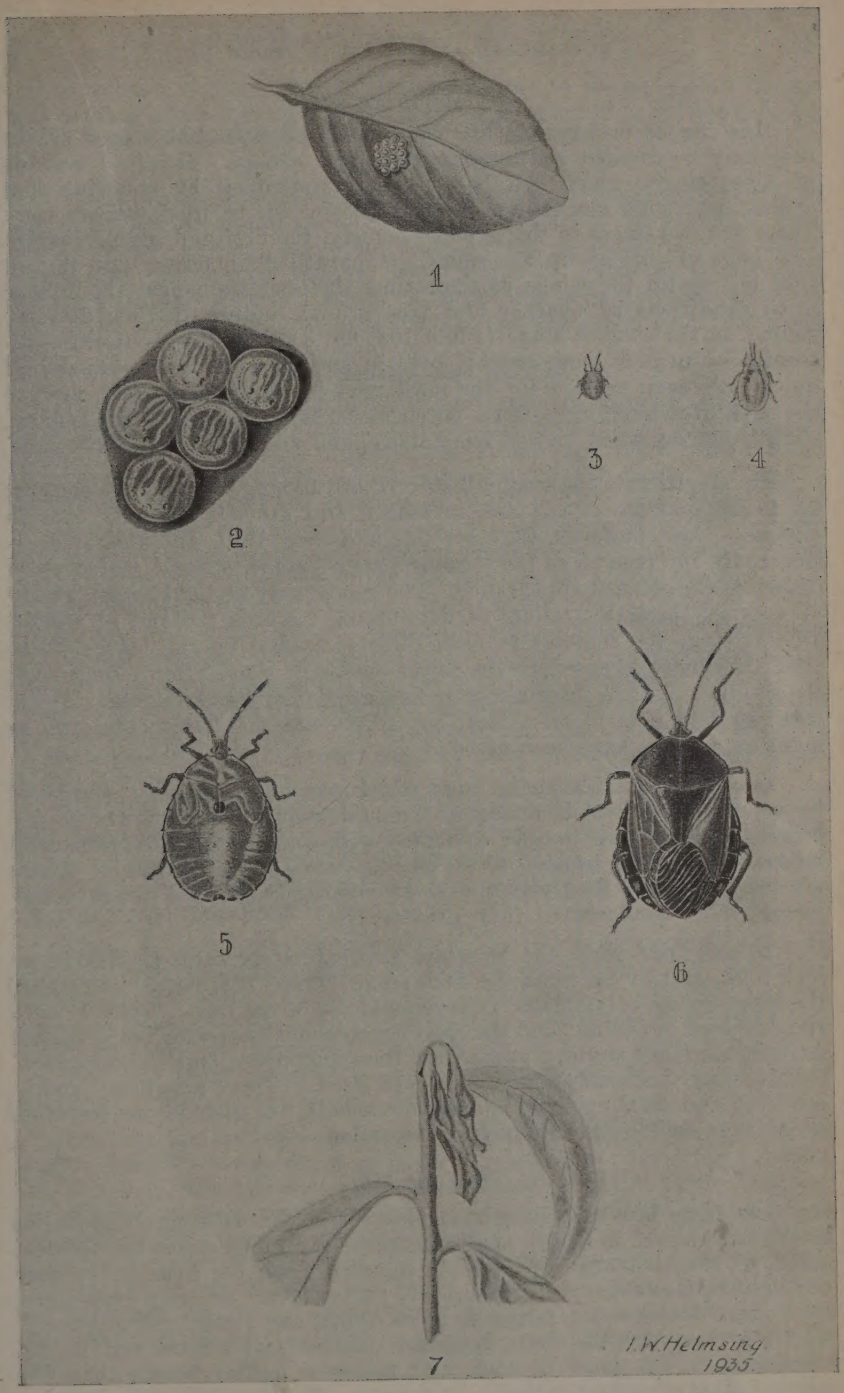

PLATE 108.

THE BRONZE ORANGE BUG (*Rhœcocoris sulciventris* Stål.).

Fig. 1. Egg cluster, half natural size.
Fig. 2. Eggs about to hatch (×4).
Fig. 3. First instar, natural size.
Fig. 4. Second instar, natural size.
Fig. 5. Fifth instar, natural size.
Fig. 6. Adult, natural size.
Fig. 7. Young citrus twig damaged by bug, half natural size.

Nymphal Instars.

Insofar as orchardists are concerned the nymphal stages of the pest may be divided conveniently into two groups. Group 1 consists of those stages which can be efficiently controlled by spraying, but against which no mechanical method known can be made satisfactory. There are two stages in this group—namely, the first and second instars. The bugs of this group are small, comparatively inactive, and do not feed but spend the whole of their time sheltering amongst the foliage until conditions of weather and tree growth induce further development. In the earliest stage (Plate 108, fig. 3) they are about three-sixteenths of an inch long, roughly oval in outline, and though capable of quick movement remain for the most part in groups generally close to the site at which they were hatched. They are rather fat-looking, slightly convex when viewed from above, and are glossy green in colour.

On moulting to the second instar (Plate 108, fig. 4) the bugs measure up to one-quarter of an inch in length and are still roughly oval in outline. Now, however, they are flat and very thin, and this stage is commonly referred to as the "tissue paper" stage, a name which aptly describes the general appearance. The colour may be light green, yellow or greyish, the latter colour predominating towards the end of winter. In this stage the insects are most difficult to find on the leaves where they lie closely apposed to the lower surface. Soon after moulting to the second stage the insects scatter to a greater or lesser degree. Mostly three or four remain on a leaf, but thirty are not uncommon, and as many as seventy have been noted.

Group 2 contains those bugs which are not efficiently controlled by spraying, but which, owing to the ease with which they can be dislodged from the tree, may be combated with some success by mechanical means. This group consists of the third, fourth, and fifth instars. These are larger in size, feed voraciously on outside twigs, and are in consequence more congregated than previously.

In the third stage the bugs are approximately three-eighths of an inch long, and by the time the fifth stage (Plate 108, fig. 5) is reached the length may be as much as seven-eighths of an inch. They remain roughly oval in outline, and the most conspicuous character is the colour. At first they are shining green, but this disappears and lighter green, orange, and brilliant pink forms are seen. They are now readily observed and their presence is made obvious by the malodorous secretion which they emit on the slightest provocation.

The Adult.

The adult bronze orange bugs (Plate 108, fig. 6) are robust insects measuring an inch in length and five-eighths of an inch across the greatest width of the abdomen. When first moulted from the fifth instar they are light bronze above and reddish-brown beneath. As they grow older the colour darkens and finally is black above and dark brown beneath. The legs are reddish-brown becoming lighter and almost red at the extremities. The head is small and the eyes lighter brown than the surrounding parts and rather conspicuous. The antennæ or feelers are reddish-brown at the base, but the second last and the last joints are orange-coloured. If the wings be pulled aside the upper surface of the abdomen is seen to be orange or reddish towards the centre and dark

brown to black at the margins. The adults can fly strongly, and though they remain quiet most of the day it is not uncommon to see them flying about from tree to tree.

Allied Insects.

There is no likelihood of the bronze orange bug being confused with any other species found on citrus in this State. A very similar bug, *Stilida indecora* Stål, has been recorded from citrus in New South Wales, but this species has not been found on citrus in Queensland. All the other species which attack citrus in Queensland are smaller than the bronze orange bug, and furthermore they are green in colour when adult.

Life History and Habits.

The bronze orange bug has but one complete life cycle each year. Eggs are laid in February and March, and even as late as April in some years. These hatch fairly quickly, the minimum time recorded being eight days. The young on hatching remain for the most part congregated until the time of the first moult, which usually takes place in five or six days after hatching. The second stage bugs then scatter more or less and take up positions on the under surfaces of the leaves in protected places. The bugs remain in this position for almost seven months, and during the whole of this time they do not feed. Nymphs of this stage have been kept alive in containers without food or even moisture for several months. High temperatures appear to be the only factor adversely affecting the insect in this stage, and on warm days it has frequently been observed that half an hour of direct sunlight proves fatal to the great majority. In this stage the insect clings very tightly to the leaves and cannot be dislodged by even very strong jarring of the limbs.

Thus the winter is passed in a quiescent state, and though thousands may be present on a tree it suffers no ill-effect. Even the closest examination at this time may fail to give any idea of the degree of infestation, and it is useless orchardists making examinations at this time to decide whether or not spraying is necessary.

With the return of warm conditions the tree begins to make growth and the bugs become active. Feeding is commenced and the third instar nymphs begin to appear in numbers early in September. The bugs are now more conspicuous as they become brightly coloured and larger and move to the outside twig growth to feed. Even before they are observed their presence is obvious on account of the foul smell associated with them from this time onwards.

Each of the last three instars occupy about three weeks or a little longer, and thus the adult stage may be reached in November. Adults are, however, as a rule not numerous until early in December. December and January are passed in feeding and mating, and eggs are again deposited in February as described earlier. No data has been obtained as to the number of eggs each female may lay, as it is rather difficult to keep the adults alive in capativity, and in all cases in which this was attempted death was obviously premature. It is, however, certain that each female can lay several batches, each consisting of fourteen eggs.

For the most part the bugs feed on the tenderest twig growth available, and the insect is thus essentially a pest of vigorous trees. To a certain extent very tender fruit, and the stalks of fruit, leaves, and flowers are also chosen as feeding sites. Attacked fruit, leaves,

and flowers are quickly shed and young twigs wither and die back, generally to the limit of hardened growth. Heavily attacked trees occasionally have practically the whole of the young fruit removed and, in addition, the wood which should carry the following crop also weakened or destroyed. Trees which carry many bugs for several successive years lose vigour and ultimately make little new growth. Furthermore, what growth is produced is usually short and incapable of carrying even a fair crop.

The bugs prefer the cooler side of the tree and the higher branches, and thus it is in these positions that the greatest amount of injury is usually noted.

When dislodged from the tree the nymphs, particularly the older stage ones, immediately turn and crawl towards the base of the tree. If undeterred they reach the base quickly and return up the trunk to the extremities of the branches.

The secretion is an almost colourless volatile liquid which the bugs can squirt a distance of as much as 2 feet. It is very corrosive and causes severe burning when it lodges on tender parts, temporary blindness often resulting when the fluid strikes the eye. The fifth stage nymphs and adults are quite aggressive in discharging this secretion. On the approach of a person they often manoeuvre their bodies so that they can eject the maximum amount of fluid in the direction of the intruder. They do not wait to be touched, but will discharge at a person merely passing within a foot or two of the twig on which they happen to be.

Control.

The all-important subject of control will be discussed under two headings—namely, control by the incidence of natural enemies and by artificial means.

A. Natural Enemies.

Though a number of insects prey on the pest the degree of natural control exercised by these in the orchard is very small and of little or no material value. Egg parasites are rare and predatory bugs, chiefly Asopidæ, are also uncommon, by far the greatest degree of natural control being exercised by insectivorous birds. Several species of birds are concerned, and where they are allowed to work unmolested they frequently do excellent work. Orchardists should protect these useful birds as far as they possibly can.

B. Artificial Control.

Artificial control can be accomplished either by mechanical means or by spraying. Of the two the spraying method is much to be preferred on commercial orchards, not only because it is so much more efficient as an actual control, but also because when correctly carried out the other effects of the spray are wholly beneficial, whereas the other effects of the best mechanical method are injurious to the tree.

Mechanical Means.

The mechanical method depends for its success on the fact that when in the last three nymphal instars the bugs can be dislodged readily from the trees. In this method the tree is jarred by the main limbs, each being tapped sharply with a padded mallet. The most satisfactory mallet is one of wood 12 to 18 inches long, so shaped that it can be

easily held in the hand and at the same time have most of the weight towards the head or striking end. The striking end should be wrapped in rubber or some such material to prevent excessive bruising or breaking of the bark. The limbs should be struck in rapid succession rather than heavily, as not only does this minimise the injury but is more effective in bringing the bugs to the ground. Prior to the banging the soil around the base of the trunk should be hilled up so as to form a smooth cone with sharply inclined sides. A strip of galvanised iron or other such material about 7 inches wide may be substituted for the cone. The strip is arranged so as to form a barrier around the trunk. On falling to the ground the bugs at once commence to crawl towards the trunk. Their progress is impeded by the barrier of earth or other material, and thus become congregated and can be dealt with easily. The destruction of the bugs may be carried out in any convenient way. Burning with blow lamps while they are still on the ground is the most usual method employed, but placing them in a container half filled with kerosene and water or other poisonous liquid is also practised. Burying cannot be recommended.

This method can be employed only when the bugs are in the third, fourth, or fifth instar. In practice it is not wise to wait much longer than is actually necessary, for the breeding is not quite even, and if the work is left until too late in the year a proportion of the bugs may have become adults and thus escape.

Tapping of the trees has little to commend it. It cannot be expected to give more than about 70 per cent. control, and quite frequently it gives considerably small percentages. Apart from the low efficiency, the operation, no matter how carefully carried out, always results in injury to the trees. Bruising and breaking of the bark favours the entrance of borers and diseases. Again, the tapping must be done at that period of the year when the bug has already done a certain amount of damage, and also at a time when the crop is just setting. The result is that in every case an appreciable amount of fruit is lost. It is impossible to carry out the work thoroughly without causing some of these ill effects.

Handpicking is sometimes employed, but it is very slow unpleasant work and is far from efficient except on very small trees. Unfortunately it is not work that can be given to children, as the bug secretion is too severe on tender skin and the eyes.

Mechanical methods then are to be recommended only when special circumstances render the use of the spray impracticable or not economical. This should vary rarely, if ever, happen on a commercial orchard. The only value mechanical methods have in ordinary circumstances is for use on single garden trees, and even with these it would generally be found better to use the spray.

Spraying Method.

The formula of the spray for use against the bronze orange bug is as follows:—10 lb. resin, 3 lb. caustic soda of good commercial quality, 1½ lb. fish oil, preferably herring oil, and 40 gallons water. It is essential that the spray be correctly prepared, and attention should be given to the details which follow. Grind up the resin as finely as practicable and then either mix the resin and caustic soda while dry and add the mixture to 2 gallons of water, or dissolve the caustic soda in 2 gallons of water and add the resin slowly while the solution boils

gently. The latter method is generally used, and appears on the whole to be the more satisfactory. The solution expands appreciably when hot, and the container in which it is boiled should therefore be considerably larger in capacity than the volume of the water, otherwise boiling over may occur. The solution should be kept fairly well stirred whilst being boiled to prevent any solids from sticking to the bottom. A light brown or creamy scum appears on the cooling surface of the mixture, the boiling of which should be continued until a clear dark liquid can be detected beneath the scum. The fish oil is then added and the whole boiled for a few minutes to ensure that no free oil remains. The concentrate thus prepared is then ready for dilution with 38 gallons of cold water. The agitator should be kept running whilst the spray is in the vat. When the concentrate cools a good deal of solid is precipitated, and thus when large lots are prepared it is necessary to divide the stock solution while hot. This may be done by dividing up as soon as prepared, and as most spray vats in use in Queensland have a capacity of either 40 or 75 gallons, the stock solution will be most conveniently divided into lots of 2 or $3\frac{3}{4}$ gallons. If the concentrate is to be stored the fish oil should not be added before storage unless the mixture can be kept in perfectly airtight containers. If preferred, however, a concentrate can be prepared as described up to but not including the addition of the fish oil. This concentrate can be stored in bulk until required when it is reheated, the fish oil added and the mixture again boiled for a few minutes. This final concentrate can then be diluted to spray strength.

The results obtained against the bug will depend absolutely on the thoroughness of application. To effect a kill the bugs must be hit at the time of spraying, as the spray is purely a contact one and dries quickly. The best results will be obtained by spraying the outside of the tree first. Whenever the bugs are molested they immediately commence to crawl down the branches. Thus by spraying the outside first those bugs which are merely disturbed will crawl at once into positions in which they are more easily hit from the inside. This method of spraying is, of course, the reverse of what is usually recommended, and is only practicable on fairly large trees where the operator can stand well inside the tree and avoid the heaviest drip.

It may be pointed out that the great majority of bugs, even though dead, do not fall from the tree for some considerable time, and, therefore, it is not possible to obtain any idea of the amount of good done merely by inspecting the ground under the trees immediately after the spraying. A careful examination of the tree an hour later will, however, generally give a good indication of the "kill."

Though the spray is somewhat effective against all active stages of the pest, by far the best results are to be obtained against those in the second instar. As will be seen from the life history notes this stage is to be found from the early part of March at least until August. Spraying, therefore, should always be done during the period intervening between those months. It does not matter greatly just when the application is made within that period, but it is wise to do it as early in the year as is convenient, preferably late in March or early in April. If left too late it may hamper other work, and at the same time the maximum beneficial effects of the spray may not be secured. The spray, in addition to its effect on the bug, is a very efficient scalicide, and further has a marked cleansing effect on the skin of the fruit.

Though the spray is sticky it disappears quickly from the fruit, and there will be no necessity to wash off any residue if the fruit be left on the tree for three or four days after application.

The only ill-effect noted after extensive use of this spray mixture by orchardists has been when it was used in very hot weather or when the preparation of the spray was faulty. In regard to the former the weather is never very hot during the period recommended for application against the bug, and no ill-effects have been noted when the temperature did not exceed 90 degrees F. With respect to the preparation, this is simple enough, and the few mistakes made have been through the use of shortcut methods in futile attempts to save a little time.

QUEENSLAND SHOW DATES, 1935.

March.

Allora, 6 and 7.
Milmerran, 12.
Goombungee, 15.
Pittsworth, 20 and 21.
Warwick, 26 to 28.

April.

Toowoomba, 1 to 4.
Tara—Show 3, Campdraft 4.
Dalby, 10 and 11.
Crow's Nest, 10 and 11.
Oakey, 13.
Kingaroy, 11 and 12.
Chinchilla, 16 and 17.
Nanango, 16 and 17.
Miles, 24.
Sydney, 15 to 24 April.
Dirranbandi, 24 and 25.
Rosewood Campdraft, 27.
Taroom Campdraft, 29.

May.

Wallumbilla, 1 and 2.
Taroom, 1 and 2.
Beaudesert, 1 and 2; Campdraft, 3 and 4.
Wondai, 2 and 3.
Goondiwindi, 3 and 4.
Longreach, 6 to 9.
Murgon, 9 to 11.
Blackall, 13 to 15.
Mitchell, 15 and 16.
Mundubbera, 15 and 16.
Goomeri, 15 and 16.
Barcaldine, 21 and 22.
Ipswich, 21 to 24.
Gympie, 22 and 23.
Biggenden, 23 and 24.
Toogoolawah, 24 and 25.
Kalbar, 25.
Maryborough, 28 to 30.

June.

Marburg, 1 to 3.
Wowan, 6 and 7.
Bundaberg, 6 to 8.
Lowood, 7 and 8.
Boonah, 12 and 13.
Esk, 14 and 15.
Warrilview, 15.
Rockhampton, 18 to 22.
Mackay, 25 to 27.
Laidley, 26 and 27.
Proserpine, 28 and 29.

July.

Gatton, 3 and 4.
Bowen, 3 and 4.
Ayr, 5 and 6.
Townsville, 9 to 11.
Cleveland, 12 and 13.
Rosewood, 12 and 13.
Charters Towers, 16 to 18.
Cairns, 23, 24, 25.
Atherton, 30 and 31.

August.

Caboolture, 2 and 3.
Pine Rivers, 9 and 10.
Royal National, 19 to 24.

September

Imbil, 6 and 7.
Tully, 13 and 14.
Innisfail, 20 and 21.
Rocklea, 21.
Kenilworth, 28th.

Diseases of the Banana.

By J. H. SIMMONDS, M.Sc., Plant Pathologist.

BUNCHY TOP.

BUNCHY top differs considerably from the usual conception of a plant disease. It is not caused by a fungus or bacterial parasite, but by an infectious agent or virus which is very much smaller than either of these. Although this virus cannot be seen by even a high-powered microscope, it is known to live and multiply in the sap of the diseased plant. In most virus diseases the affected plant has no definite lesion such as a spot or rot, but is usually stunted and abnormal in foliage or fruit development.

In the case of bunchy top the leaves formed after infection are short and narrow with the margin distinctly up-curved. They fail to bend over normally and retain a stiff erect habit which, combined with the fact that the leaf stalk is greatly reduced in length, gives the characteristic rosetted appearance to which the disease owes its name. The foliage on such plants is crisp and brittle when crushed. A bunch is rarely produced unless infection has taken place late in the life of the plant.

Effective control of bunchy top necessitates recognising the disease in its early stages. A plant should be regarded with suspicion if the youngest leaves exhibit a light green colour along the edge and have blades which dip back sharply from the midrib and curve in again conspicuously from the margin (Plate 110). A definite and unquestionable diagnosis can then be made by examining the base of the youngest leaf from the underside and with the light behind it. If the plant is infected there will be seen narrow dark-green lines, broken in a dot and dash manner or sometimes continuous, lying between and parallel to the clear veins which run out at right angles to the midrib (Plate 109). There is also often one or more wide dark-green streaks running down the outside of the leaf stalk near its junction with the pseudostem.

Bunchy top is spread in the plantation by the banana aphis when it sucks the virus-infected sap of a diseased plant and then leaves it and feeds on a healthy one. Aphids may travel considerable distances in the air, and this accounts for isolated outbreaks of bunchy top in plantations otherwise free from the disease.

In a single stool the virus from a diseased parent plant may travel in the sap stream down to the corm and thence out through the connecting tissue to the young suckers, which will in turn develop the disease, usually remaining in a stunted and rosetted condition. The possibility of sucker infection has an important bearing on the control measures discussed below.

Control.

There is no known method of destroying the virus in the plant without destroying the plant itself, and hence anything in the nature of a cure is impossible; nor is it commercially practical to destroy all aphids in a plantation and so limit the spread of the disease by this means. It, therefore, becomes necessary to concentrate on eliminating the source of supply of the virus by exclusion and destruction of diseased plants.

Firstly, care must be taken that all suckers used for planting are free from bunchy top infection. The agents of the Banana Industry Protection Board are in a position to advise growers where suitable planting material may be obtained. They should also be consulted regarding the current planting policy, as a planting permit may have to be refused if the spread of bunchy top or other disease or pest is involved.

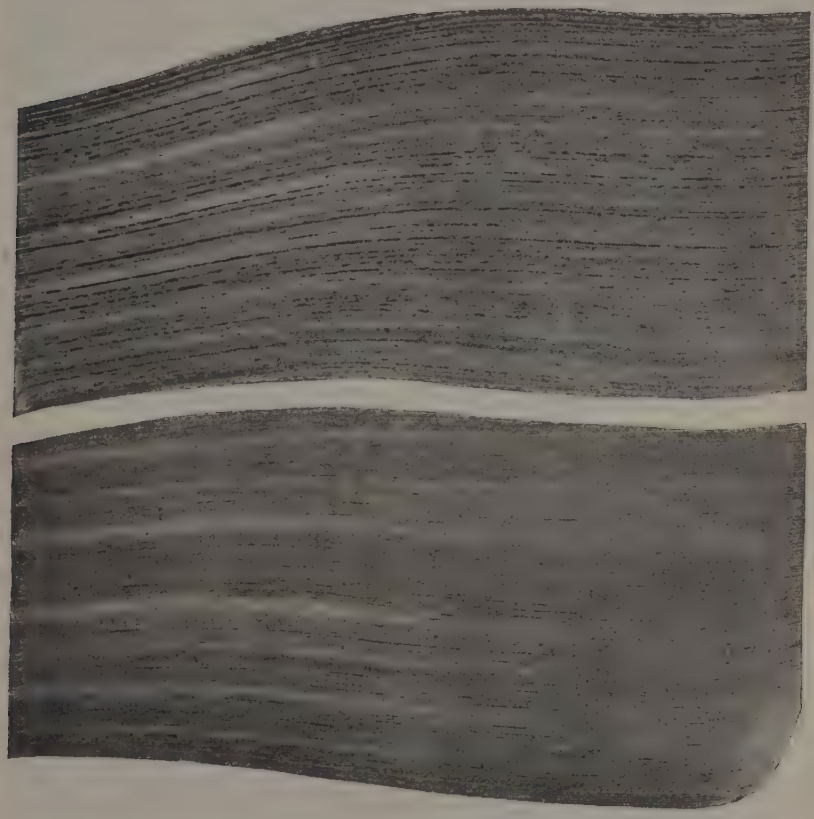

Plate 109.—Bunchy Top.

Portions of banana leaves photographed from the underside by both transmitted and reflected light. Above: Leaf from bunchy top infected plant showing the characteristic dark dots, dashes, and lines. Below: Leaf from a healthy plant for comparison.

Secondly, diseased plants must be destroyed as soon as they show the first symptoms of infection. Thorough inspections should be made for the purpose of locating bunchy top plants. The frequency of these inspections will depend on the amount of bunchy top present, and must ensure that in every case the diseased plant is found as soon as the infection becomes recognisable. Eradication must follow immediately, and to be effective the following procedure should be followed:—

To prevent aphids leaving the diseased plant for a healthy one first pour not less than half a pint of pure kerosene into the central

leaf of the affected plant and other plants connected with it in the same stool. Wait for a few hours to allow the kerosene to trickle down round the leaf bases and so kill all aphids present. Then dig out the stool, including the infected plant and any others connected with it, and chop into small pieces to facilitate drying.

Heart Rot.

A second virus disease of bananas is now known to occur in this State. Although this disease is widely distributed throughout Southern Queensland it fortunately has not exhibited the capacity for rapid spread that has made bunchy top so serious. The characteristics of the disease vary at different times of the year. The most general symptom is a chlorotic condition of the younger leaves formed by light green to yellow streaks or bands which extend out from the midrib. These streaks may be narrow and interrupted so that a mosaic effect is produced (Plate 111). During the colder months a soft black rot may involve the funnel leaf and develop down into the heart of the plant. If this rot reaches the corm the whole plant may die. Often, however, with a change in environmental conditions the extension of the rot will cease, but the new leaves coming away may be narrow with irregular and blackened edges resulting from the previous rotting of their margin. As in the case of bunchy top the virus may pass from a diseased plant to the suckers with the production of a stunted and heavily mosaic-marked plant.

The cause of heart rot was first investigated by Magee in New South Wales. He showed that the disease was due to an infectious virus which was carried from infected to healthy plants by the banana aphis. Heart rot therefore resembles bunchy top in this respect. As would be expected, the control measures advocated in the case of the latter have so far effectively checked the spread of the former disease. Briefly, the recommendations are as follows:—

1. Plant only disease free suckers.

2. Kerosene and dig out an affected stool immediately heart rot symptoms are noticed.

Leaf Spot and Speckle.

Although leaf spot and speckle are probably distinct diseases they will be considered together here since they are usually both present in the plantation, and the final effect on the plant is very similar in each case.

Leaf spot is caused by the fungus *Cercospora musæ*. It is a disease which is widely distributed outside Queensland occurring as it does in India, the Eastern Tropics, and Fiji. The spots are easily recognised and are most prominent on the upper surface. They consist of narrow, oblong, or elliptical, brown to black, areas about half an inch long by an eighth in width. With age the centre dries out leaving a characteristic grey spot bordered with a black line and surrounded by a yellow halo. Usually the grey spots are still easily distinguishable after the leaf has dried out (Plate 112). Minute greyish tufts of fungus spores can sometimes be seen on the surface of the spots following prolonged rainy weather.

Speckle is found on the under surface of the leaf as scattered or aggregated dark brown to black blotches of varying size and intensity. These dark patches are formed in the first place by a close speckling

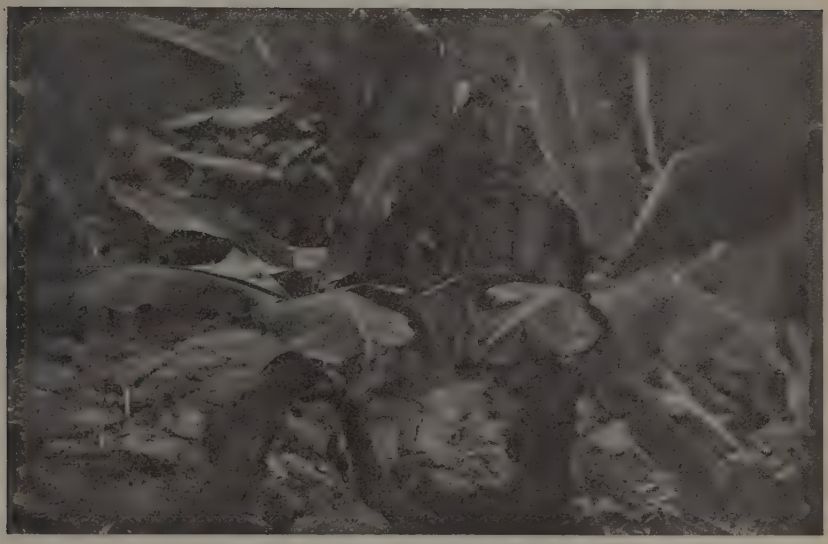

Plate 110.—Bunchy Top.

Two banana plants showing the symptoms of a fairly recent infection with bunchy top. In the younger leaves notice the dipping back of the blades from the midrib and the incurved and waved condition of the margin.

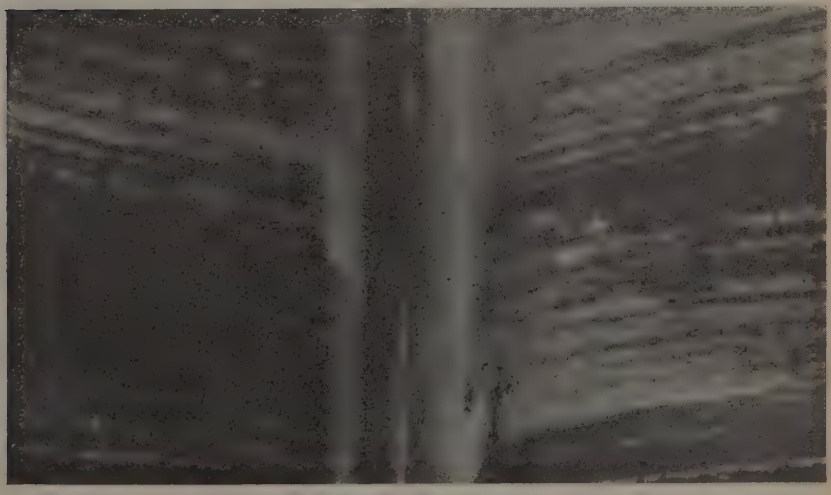

Plate 111.—Heart Rot.

Portion of a leaf showing the characteristic mosaic banding.

of the surface with greyish dots which later darken and coalesce (Plate 113). The cause of speckle is not as yet definitely known, although it is evidently of fungus origin. Its distribution is as wide as leaf spot.

Leaf spot is usually most abundant towards the outer end of the leaf, whilst speckle is, if anything, more prevalent towards the base. A shaded situation may definitely favour the development of the latter, but not the former. With both diseases the lower leaves are attacked first, and if the spots are numerous the individual lesions will coalesce and form large peninsulas of dead tissue extending from the margin in towards the midrib. Eventually the whole leaf will dry out. This results in a gradual defoliation of the plant from the base up and under average plantation conditions on growing plants an equilibrium is reached at which there are usually three leaves unaffected and four to five with leaf spot and speckle present in increasing intensity from above downwards. This is apparently sufficient leaf area to support the growth of the plant, and it is doubtful whether the initial size of the bunch when thrown is greatly affected by these leaf diseases. However, once the bunch is out no further leaves are formed, and the gradual invasion and consequent death of those present deprives the bunch of its normal shelter, with the result that the fruit often fails to develop properly and may become badly scalded.

Leaf spot and speckle are usually present at all times of the year, the relative importance of each varying somewhat with environmental conditions. Both diseases are favoured by wet weather, but in the case of leaf spot three or more days of continuous rain during the moderately warm weather of February, March, or April appears necessary for an epidemic outbreak. The leaf defoliation is most serious during the winter months when growth is at its slowest. In the Spring the situation changes and the plants tend to outgrow the disease. Conditions such as poor drainage, unsuitable soil and aspect, cold and heavy weevil borer infestation will add to the seriousness of leaf disease by retarding the growth of the plant, and even on their own account in the absence of disease may be responsible for abnormal leaf fall.

Control.

From the above discussion it will be seen that the maintenance of a continuous vigorous growth will help towards reducing loss from these diseases. In this connection it must be remembered that the banana is essentially a tropical plant and greatly affected by cool temperatures. The broad flexible leaves and other growth characters indicate that adequate shelter from strong winds and abundant and evenly distributed moisture are necessary. The roots are adapted to a loose well-drained soil adequately supplied with humus, and will suffer if exposed to extreme variations of wet and dry conditions. The provision of adequate windbreaks and the safeguarding of the better surface soil from erosion during the heavy summer rains by means of terracing, cover-cropping and other modifications of the usual cultural practice will greatly assist in maintaining the productiveness of a banana plantation in spite of the presence of disease.

Direct control of the leaf diseases by fungicides is made difficult by the nature of the banana plant itself and the inaccessibility of most plantations. Dusting has been proved to be ineffective, probably owing

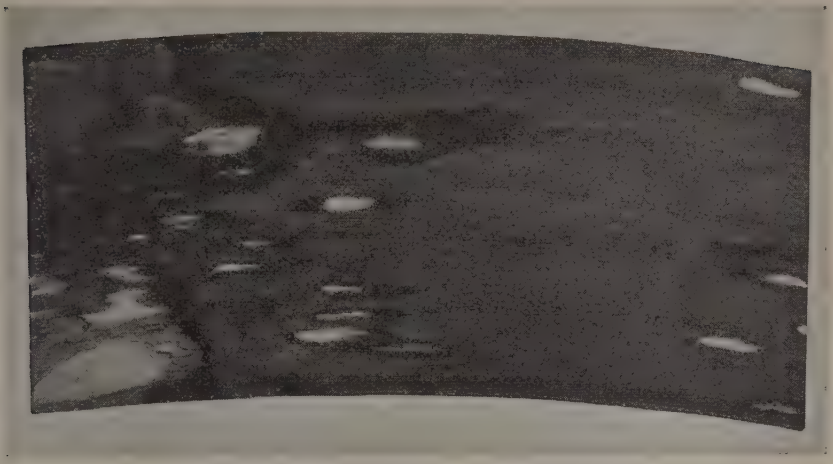

Plate 112.—Leaf Spot (*Cercospora musæ*).

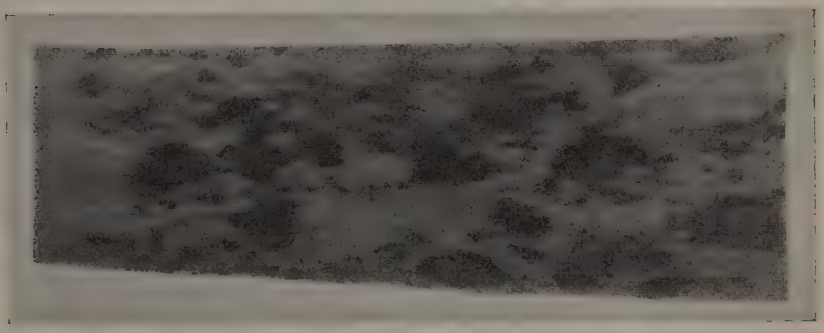

Plate 113.—Leaf Speckle.

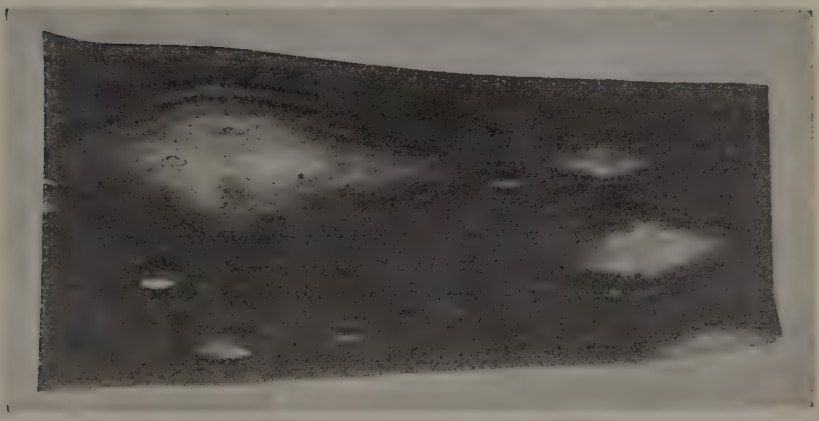

Plate 114.—Yellow Leaf Spot.

Four Cercospora spots are included in the specimen, and form a comparison as regards size. (Slightly reduced.)

to the difficulty of obtaining a permanent cover on the shiny leaf. Bordeaux mixture applied in February and March with a suitable spreader will check speckle and to a lesser extent leaf spot, but it is doubtful whether the final results obtained justify the trouble of spraying such a crop as the banana.

Perhaps the most practical method of reducing the loss due to leaf defoliation is to protect the developing bunch from exposure by covering it with bagging. Two methods are available. The bunch may be entirely enclosed in a hessian bag of suitable size. This procedure results in the greatest final benefit, but the slowness of the operation and the difficulty of determining the correct cutting maturity are decided disadvantages. In the second method half a corn sack is used. This is rapidly thrown over the exposed side of the bunch and secured behind with a nail. All bunches likely to be exposed should be covered as soon as the fruit commences to fill out, the correct time being largely a matter of experience. In order to provide for the heavy defoliation in winter and spring bagging should commence in April and continue throughout the winter so long as bunches are left without leaf protection.

Yellow Leaf Spot.

This leaf spot is serious only in the northern parts of the State, where it may cause leaf defoliation in a manner similar to Cercospora leaf spot. The disease commences on the lower leaves as indefinite light yellow areas. These take up an elliptic or more characteristically a definite diamond shape, turn deep yellow, and then gradually darken in the centre where they dry out to dark brown, leaving a narrow but distinct yellow margin (Plate 114). These spots, except in the very earliest stages, are considerably larger than those caused by *Cercospora musæ*, and may be as much as 3 to 4 inches long by 1 to 1½ inches broad. Young plantations may suffer badly from yellow leaf spot, whereas they are usually free from severe attacks of the other leaf diseases.

Yellow leaf spot is apparently caused by the fungus *Cordana musæ*, whose fructifications form a greyish down covering the under surface of the spots. This organism is widely distributed throughout tropical countries, but is not usually considered of as much importance as in Queensland, where severe defoliation has been known to result from its presence.

In plantations where yellow leaf spot is serious the protection of the fruit from scalding by the method described in the case of leaf spot and speckle should give some relief.

Panama Disease.

Panama disease affects only the tall-growing varieties, such as the Sugar, Lady's Finger, and Gros Michel. It is widely distributed throughout the world and has received its name from the region where it was first known to cause serious loss. The presence of the disease is indicated by the development of a deep yellow colour round the margin of the lower leaves, which later turn brown and dry out. The leaf stalk collapses, leaving the dead leaves in a gradually increasing number draped round the pseudostem.

A definite diagnosis of Panama is made by splitting up the base of the plant lengthwise, when the corm will be found discoloured by numerous brown to black lines running in all directions through the

white tissue. The brown vessels can usually be followed up through the sheathing leaf bases and out into the vertical partitions of the leaf stalk. The reddish brown lines in the latter situation are often a means of quickly identifying the disease.

Panama disease is caused by a fungus (*Fusarium cubense*) which is capable of living for some time in the soil and when a suitable opportunity offers may infect the banana plant by means of the roots or wounds in the corm. It then travels up the water conducting vessels causing the black lines already referred to. The fungus may grow out through the tissue connecting a diseased parent with the surrounding suckers, and the planting of such infected material is one of the chief means by which the disease is spread.

Control.

The only satisfactory way of dealing with Panama disease is by a combination of exclusion and eradication.

1. Only land which has not previously grown bananas or on which the disease has never occurred should be planted with susceptible varieties.

2. Obtain planting material only from a district in which Panama does not exist.

3. A plant may become infected by wind-borne spores, or by infectious material accidentally introduced on boots and farm implements. Immediately a plant shows signs of infection the whole stool should be dug out, chopped into pieces and burnt on the spot. Any instrument used in cutting a diseased plant should be washed in formalin solution or passed through a flame before using it on a healthy plant. It is unwise to replant in the same spot.

4. Unfavourable soil conditions, especially poor drainage, greatly increases the severity of Panama attack and, conversely, the provision of optimum conditions of growth for the fruit will help to diminish the loss from this disease.

Dry Rot.

Dry rot is not a disease of serious consequence, as only an isolated plant or a small group of plants is usually attacked. In an affected plant the leaves commence to die back from the margin and eventually the whole of the foliage becomes brown and dry. The pseudostem may be easily pushed over owing to the absence of sound roots. The normal corm tissue is largely replaced by a more or less dry, punky substance of a dirty white to brown colour. This consists of a mass of closely interwoven fungal threads which have invaded the corm and largely replaced the plant tissues.

Dry rot is caused by certain of the mushroom and bracket fungi, including a *Poria*, all of which live for the most part on dead and rotting stumps such as are present in abundance in the average banana plantation. From here it is possible for them to pass to a living banana plant should one be growing in close proximity and by invasion of the corm produce the dry rot described above.

In order to prevent the spread of dry rot to adjacent stools it is advisable to locate, if possible, the stump or roots from which infection has proceeded and remove and burn this material together with the infected corm.

Cigar End.

Cigar end is a trouble affecting relatively young fruit in the plantation. A firm dark decay commences at the apex of the fruit surrounding the dead floral parts. This rot extends back slowly for half an inch or so, causing the tissue to shrink and become more or less rounded in contrast to the angular nature of the immature fruit (Plate 116). There is a sharp line of demarcation between healthy and diseased tissue. Usually no further extension takes place, but the fruit ripens prematurely. The disease is caused by a fungus (*Stachylidium theobromæ*). The spores of this organism are produced in abundance on the surface of the blackened area, where they form an ashy grey or pinkish grey coat. In typical cases this gives to the shrunken end a striking resemblance to a burnt cigar tip, hence the name. The old shrivelled floral organs often persist for considerably longer than normally on affected fruit.

Although occasionally a large proportion of the fruit in a bunch is affected, it is more common for only a few fingers to show the disease; hence special control measures are not usually required. However, it is a wise precaution to open up the young bunch, where necessary, to the light and air and to remove the bracts which tend to remain attached to the developing hand, especially during wet weather. After a spell of dry weather when choke throat is in evidence, splitting the top of the pseudostem may be necessary to relieve the pressure on the outcoming bunch and so avoid injury to the tips of the fingers.

Black Finger.

While the bunch is still young and the fruit immature and angular one or more fingers may develop a jet black decay commencing at the tip and extending back towards the base until, unlike cigar end, the whole of the fruit is involved. The fruit becomes tapered by the gradual shrinkage of the affected region, which remains firm and eventually dries up to form a mummy (Plate 117). In the later stages numerous minute raised pustules constituting the fruiting bodies of the causal organism appear over the surface.

The cause of black finger has only recently been investigated. A fungus (*Phoma sp.*) has been isolated from affected fruit, and its pathogenicity proved by artificially inoculating healthy fruit on the plant and in the laboratory.

So far this disease has not appeared with sufficient frequency to call for special control measures, but the ventilating of the young bunch as for cigar end should help to prevent its occurrence.

Gumming.

Fruit which have developed gumming can be readily distinguished, as the bunch begins to fill out, by a tapered or pinched appearance of the flower end. One or more fruit so affected may be scattered through the bunch. On splitting the fruit lengthwise a reddish brown gummy condition of the tissues below the flower tip and extending along the centre will be apparent. Dark gummy specks of less intensity may form a more or less interrupted band along the outer margin of the pulp. Affected fruit does not ripen as soon as the normal, the tip in particular remaining green.

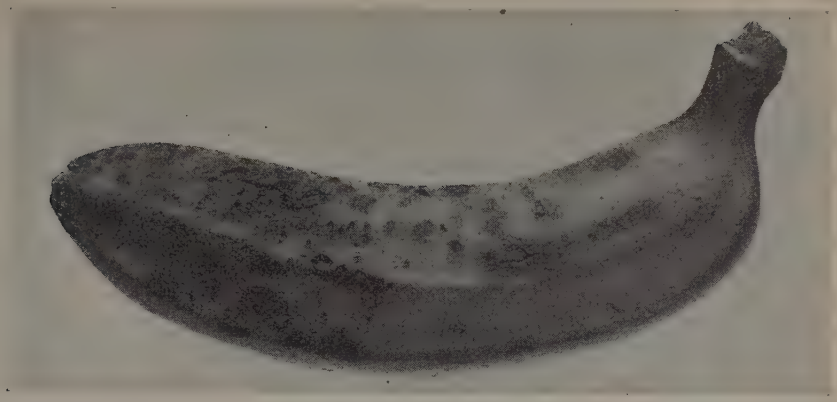

Plate 115.—Black Pit.

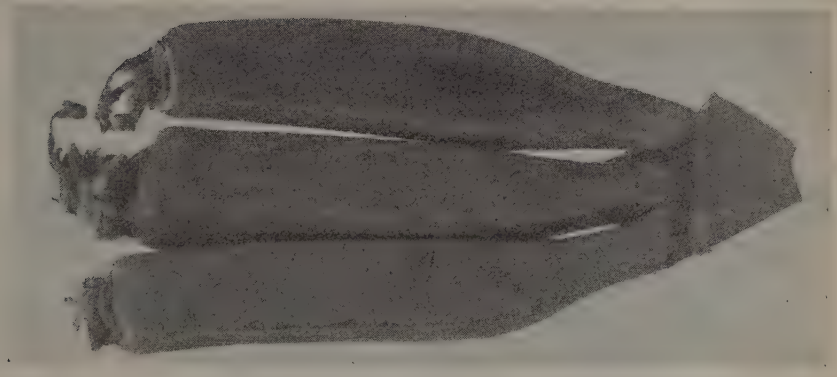

Plate 116.—Cigar End.

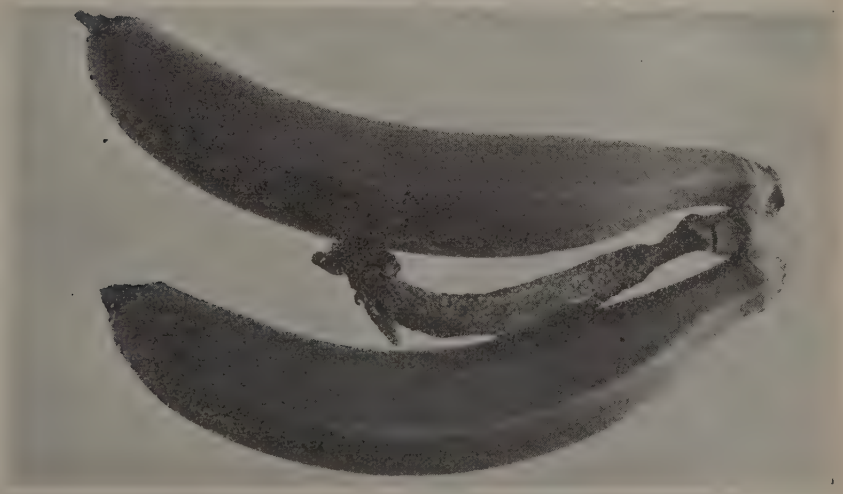

Plate 117.—Black Finger.

A disease occurring in the West Indies which closely resembles this one has been shown to be due to infection by a bacterium through the floral organs of the young fruit. As bacteria have in the past been isolated from Queensland specimens, it is possible that the same trouble exists in both countries.

So far it has not been necessary to take special precautions for the control of this disease, though the remarks already made regarding the opening up of the young bunch and the removal of bracts can be applied here also. All fruit having the characteristic pinched tip should, of course, be rejected when packing.

Black Pit.

Black pit has made its appearance on frequent occasions since it was first recorded in 1930. Commencing as small reddish spots, shallow black pits of $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter are formed in the skin of green fruit (Plate 115). The spotting is most abundant on the upper hands of the bunch and on mature fruit.

The lesions are restricted to the skin and do not usually act as centres for any further decay. However, when the pits are numerous the disfigurement is sufficiently serious to render the fruit unfit for market, and at times whole bunches have had to be discarded.

The cause of black pit is not definitely known, but it has been observed that bunches bagged in the manner advised in connection with leaf spot develop few or no spots. Accordingly this means of reducing loss is recommended in plantations subject to the disease.

Squirter.

Squirter is a disease rarely seen in Queensland, since it usually makes its appearance in cased bananas after arrival on the Southern markets.

A fruit typically affected with this disease has the pulp decomposed to a dark semi-fluid state so that a squeeze of the hand will expel it in a stream from the stalk end. At an earlier stage there will be found a dark area of rotting tissue lying along the centre of the fruit with or without an obvious connection with the finger stalk through which infection almost invariably occurs (Plate 118). External symptoms may take the form of a blackened stalk, but are often lacking altogether.

The disease is caused by a fungus (*Nigrospora sphærica*), which for the most part exists in a non-parasitic manner on leaf bases, the bunch spathe or other dead banana material in the plantation, and on discarded bunch stalks and rotting fruit in the dumps near the packing shed. The shiny black fungus spores produced in these situations are liberated into the air and contaminate the fruit either in the plantation or during packing operations. The fungus then gains entrance through the broken fruit stalk and travelling down the vascular fibres sets up the typical rot in the pulp of the fruit.

Squirter does not develop when the fruit is in the unsprung or in the fully ripe condition, but in the intermediate stages. About ten days are necessary for the complete rot to take place. The disease is seasonal in its occurrence and is met with only in the cooler months from May until late spring. Chilling may have some indirect bearing on squirter development, and the delayed ripening period in the winter months may also be a factor in its seasonal distribution.

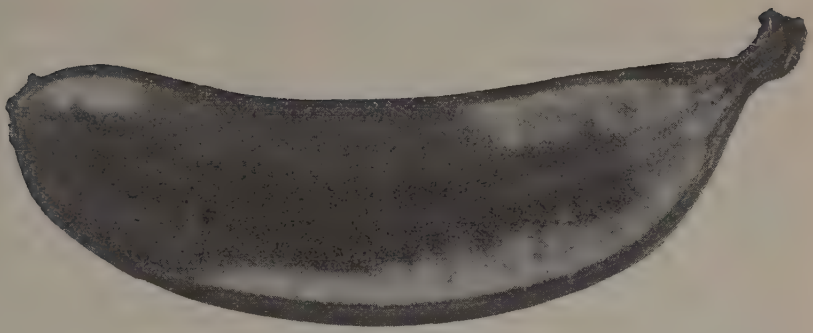

PLATE 118.—SQUIRTER.

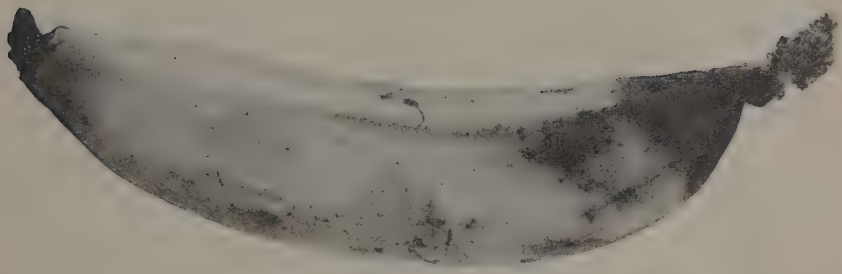

PLATE 119.—BLACK END.

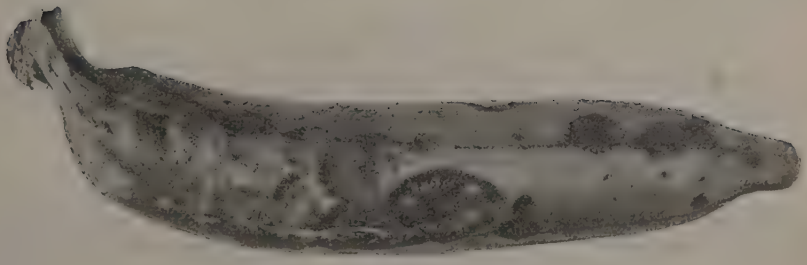

PLATE 120.—ANTHRACNOSE.

Control.

1. Plantation and packing-shed hygiene will help to reduce the number of spores present. The bunch spathe and loose trash should be removed from the vicinity of the bunch. Rejected fruit and bunch stalks should be buried or burnt and the packing shed sprayed out occasionally with a 5 per cent. solution of formalin.

2. During the winter months squirter-liable fruit should be marketed without delay and ripened as quickly as possible by up-to-date methods so that the period during which the rot can take place is reduced to a minimum.

3. Packing in part hands instead of singles will often reduce the number of fruit infected.

4. Bagging bunches during the winter months, as has been advocated for leaf spot control, may help with squirter also, as it will lessen the amount of chilling likely to take place.

Fruit Stalk Rot or Black End.

This is purely a transport and market trouble. As the fruit ripens a soft, black, and usually wet rot commences at the broken end of the fruit stalk, or, in the case of bunch fruit, in wounds caused by bending the fruit at its point of attachment to the main stem. This results in a black shrivelled condition of the fruit stalk, from whence the rot may extend to the adjacent skin of the fruit and produce a soft watery condition of the pulp beneath (Plate 119).

Various wound parasites, more especially *Glœosporium musarum*, *Nigrospora sphærica*, *Pusarium* spp., and *Stachylidium theobromæ* are associated with this type of decay. The development of *G. musarum* is favoured by high temperatures and most of the black end in summer is due to this organism. *N. sphærica* is active during the winter and supplements the work of *Glœosporium* at this time. The species of *Fusarium* and *S. theobromæ* are of comparatively minor importance and are apparently unrestricted as regards their time of appearance. All these fungi occur abundantly on banana refuse in and around the packing shed and on dead leaf stalks, bunch tracts, and other parts of the plant in the field. Consequently, contamination with the spores of these organisms is easily accounted for. Bruises caused by rough handling and the surfaces exposed by breaking the bunch into fingers then serve as points of entry for the fungus, which develops further during transport.

Control.

1. Practise packing shed and plantation hygiene as recommended for squirter control. The plants should be kept reasonably free from dead leaves by periodic trashing.

2. Cut, pack, and rail fruit with the minimum of delay.

3. During periods when black end is prevalent the consignments should be ripened immediately they arrive at the market by up-to-date methods, keeping the humidity as low as practicable during the process, and the temperature at the correct point.

4. Pack in part hands rather than singles, avoiding undue tearing when splitting up the hands.

5. In the case of fruit sold and ripened in the bunch practically all loss may be eliminated by careful handling of the fruit so as to avoid bruising the fruit stalk.

Anthracnose.

Like black end, anthracnose is mainly a marketing trouble. Dark slightly sunken areas appear on the skin of the ripening fruit and enlarge rapidly (Plate 120). At first the skin only is affected, but later a soft water-soaked condition extends into the pulp and greatly hastens what is commonly known as the overripe condition. Under moist conditions the surface of the spots becomes covered with a pinkish mass of the spores of *Glœosporium musarum,* the fungus causing the disease.

Anthracnose is of most importance during a period of two to three months in midsummer. The skin of the fruit marketed at this time appears to be of a softer nature and more susceptible to attack, and the high temperatures prevailing favour the growth of the parasite. At this time black depressed areas may be formed on green fruit in the plantation, but this is of rare occurrence.

No definite means of control are known. The recommendations made in connection with black end are applicable here also. Careful handling at all stages to avoid bruising is important. As there is a tendency for fruit to ripen quickly during the summer months when anthracnose is prevalent the correct picking maturity must be studied in order to avoid the waste associated with fruit arriving in a mixed ripe condition. Fruit should not be allowed to stand in the hot sun either before or after packing.

TO NEW SUBSCRIBERS.

New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

Inland Pastures.

PART I.

Mitchell Grasses in the Warrego District.

By W. D. FRANCIS, Assistant Government Botanist.

PART II.

Response during 1934 Season of Mitchell and Other Grasses in Western and Central Queensland.

Compiled by S. L. EVERIST, Assistant to Botanist, from reports received.

[*A Report submitted to the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, on 14th April, 1934.*]

Foreword.

By C. T. WHITE, Government Botanist.

DURING the year 1933 considerable attention was given to statements from various sources that the Mitchell grasses of Western Queensland were diminishing, due to prolonged droughts and continued stocking. Therefore, when the drought broke towards the end of 1933, it was decided to try and obtain some definite information on the response of the Mitchell grasses following the good rains experienced over most of Western and Central Queensland. It was thought expedient, too, to obtain information on other grasses and herbage plants at the same time.

In March, 1934, Dr. E. Hirschfeld, who has taken considerable interest in Queensland grasses and carried out some experiments with them on his property in the Inglewood district, Western Darling Downs, wrote to the Hon. F. W. Bulcock suggesting that I should visit Western Queensland for the purpose of making a general survey of the pastures and their response following on the bounteous season of spring and summer 1933-34. Owing to Departmental work on hand it was not expedient for me to carry out this work, but it was decided that the Assistant Botanist, Mr. W. D. Francis, should visit the Charleville area for the purpose of obtaining information from station owners and others as to the regrowth made by Mitchell grasses. A careful study was made by Mr. Francis of Mitchell grasses in the field, and the report embodying his observations and recommendations is published herewith as the first part of the general report on the inland pastures. The possibility of going on with the experiments outlined by Mr. Francis will be considered in the near future.

On the 6th March, 1934, a circular letter was sent by the Department of Agriculture and Stock to all District Stock Inspectors and Stock Inspectors in the Western and Central districts. The assistance of the Land Administration Board was enlisted and the same circular was sent to Land Commissioners and Land Rangers in the Western and Central districts.

In the circular the following questions were asked:—

1. How have the Mitchell grasses in your district responded during the present season?
2. Is there more than one kind of Mitchell and more than one kind of Flinders Grass growing in your district? If so, could you let us have specimens with notes on the relative value of each?
3. Are there any other grasses of outstanding value growing in your district and valuable on account of either palatability or drought resistance?
4. Are there any herbs of outstanding merit associated with the grasses?
5. This Department has co-operated with many graziers in Central and Western Queensland by naming and reporting on any grasses and herbage plants submitted. We would be pleased to receive any specimens you care to send. In sending more than one specimen, number each and retain a duplicate similarly numbered. Of grasses a whole stalk doubled up so as to fold comfortably in a piece of newspaper should be sent, as well as several seed-heads. Of herbs, trees, &c., a shoot a few inches long bearing flowers or seed-heads should be forwarded.

The response to this circular was very gratifying and for months reports and specimens poured into the Department.

The specimens were determined as quickly as possible and the reports were filed until all had been received.

These reports have now been examined carefully and a summary of them is given below. The report is in two sections. The first deals with the reports from the various districts. In this portion will be found notes on the response of the Mitchell and Flinders grasses, and remarks made by various officers upon other grasses and herbage of the areas reported on by them. The second section consists of a list of the more important species of grasses and fodder plants forwarded with notes on the distribution and fodder value of each. In compiling this list information has been gathered from sources other than the reports furnished by officers of the Lands Department and the Department of Agriculture and Stock. These other sources of information are acknowledged separately.

From the reports submitted it appears that in some cases a diminution in the amount of Mitchell grass has taken place. Generally speaking, however, where the country is not overstocked and where sufficient rain fell, the Mitchell grasses are as good as ever they were. In those areas where a diminution in the amount of Mitchell grasses was reported overstocking has been indulged in for a long period of years, and this, coupled with prolonged dry periods, has resulted in the gradual disappearance of the Mitchell grasses. The depasturing of horses upon them seems to have a harmful effect upon the Mitchell grasses. The horses eat the seed-heads and paw up the tusssocks, thus preventing the regeneration of the Mitchell grasses from seed or from the old roots.

Apart from the valuable notes received on the response of the Mitchell grasses, much information was received concerning the distribution and fodder value of some of the less widely known grasses and herbage plants. This information will be found set out in detail in the second part of the report.

The results obtained from the circular were certainly worth while, and the reports received have widened considerably our knowledge of the Queensland pastures.

That considerable interest is being taken in the management of the Western pastures is evident from the fact that some of the major pastoral companies have appointed pastoral research officers either to work on their own or in conjunction with the Council for Scientific and Industrial Research. The Walter and Eliza Hall Fellowship in Economic Biology was in March, 1934, awarded to Mr. S. T. Blake for the purpose of investigating the pastures of Western Queensland. These officers, particularly Mr. Blake, have worked in close co-operation with this Department. It is to be sincerely hoped that the outcome of this work will be that broad principles regarding the management of the Queensland pastures can be laid down.

PART I.

The Mitchell Grasses of the Warrego District of Western Queensland.

I. Introduction.
II. The Kinds of Mitchell Grasses.
III. Characteristics of the Mitchell Grasses.
IV. Mitchell and Flinders Grasses Compared.
V. Mitchell Grasses and their Resistance to Drought and Stock.
VI. The Past and Present Condition of the Ward Plain.
VII. Are the Mitchell Grasses Diminishing?
VIII. The Rainfall and its Effect.
IX. Suggested Tests and Experiments.
X. Some Grasses Associated with Mitchell Grasses.

I. Introduction.

THIS report outlines the results of a visit to some of the Mitchell Grass areas of the Charleville district. The visit was made in co-operation with Mr. E. J. Tannock, the District Inspector of Stock. The area visited extends about 80 miles south and 70 miles north of Charleville. The purpose of the visit was to make some observations upon the grasses in the field and to ascertain the views of pastoralists and others upon the welfare of the principal grasses of the area.

The Mitchell grasses are confined to Australia. They are not limited to any one State. They are restricted to the inland parts of the continent, or at least they reach their greaest development there. In these inland areas the rainfall is comparatively low. The Mitchell grasses are seen at their best in the areas with an average annual rainfall of from 25 to 10 inches. Mostly, if not always, these grasses are found in the richest lands. They inhabit wide plains and extensive undulating downs composed of rich, deep, black, and brown soils. In

such areas they are often the dominant components of the grass lands. On account of the very extensive areas of Western Queensland which are covered by them and because of their durable and nutritive properties the Mitchell grasses must be recognised as one of the principal natural assets of Queensland.

II. The Kinds of Mitchell Grasses.

Four different kinds of Mitchell grasses are recognised by botanists. Our knowledge of the classification of the Mitchell grasses was considerably clarified by a paper published in 1928 in the Kew Bulletin by Mr. C. E. Hubbard, the distinguished specialist in grasses of the staff of the Royal Botanic Gardens, Kew, England.

The four different kinds are enumerated:—

1. *Mitchell Grass or Curly Mitchell Grass.*—This is by far the commonest of the Mitchell grasses, at least in the Charleville area. Apparently it is the most palatable of the group. The name Curly Mitchell grass owes its origin to the fact that the leaves, especially the older leaves, often bend downwards and inwards at the point and form

Plate 121.

Curly Mitchell Grass (*Astrebla lappacea*) on Claverton, between Charleville and Cunnamulla. Forest vegetation on sky line. Mr. Tannock and Mr. McInnes in picture.

a circle or spiral. The leaves in the other kinds of Mitchell grasses often have the same tendency. This character therefore is not a reliable one upon which to distinguish this species. The botanical name of this species is *Astrebla lappacea.* (See Plates 121 and 123.)

2. *Barley Mitchell Grass.*—This species is distinguished from Curly Mitchell grass by its shorter and more compact seed-head, which is often enclosed at maturity on one side in a sheath. The seed-head of Barley Mitchell grass measures from 1½ to 5 inches long. This species is found in damper situations and in harder soils than Curly Mitchell grass. At times it grows on the margins of damp or low-lying places which are occupied by Bull Mitchell. It is often found in association with Bull and Hoop Mitchell. Its botanical name is *Astrebla pectinata.*

3. *Bull Mitchell or Wheat-eared Mitchell Grass.*—This is a coarse-growing grass with strong, prominent tall stems and a large, heavy, broad seed-head. It is commonly found in patches especially in damp and low-lying situations. It is generally regarded as much inferior to the two foregoing kinds. Its botanical name is *Astrebla squarrosa.* (See Plate 122.)

4. *Hoop Mitchell or Weeping Mitchell Grass.*—This kind is mostly readily recognised by its long, slender seed-heads often bent into a circle or semi-circle, from which it derives the name of Hoop Mitchell. The seed-heads are much more slender than those of the other kinds and vary from 5 to 14 inches in length. It is often found on harder and damper soils than those upon which Curly Mitchell grows. It is generally regarded as inferior to Curly Mitchell grass. Its botanical name is *Astrebla elymoides.*

PLATE 122.

Bull Mitchell Grass (*Astreb'a squarrosa*) in a slight depression on plain at Claverton, between Charleville and Cunnamulla. The tussocks are evident. In the foreground seed-heads of the grass are seen.

The four kinds of Mitchell grasses are represented in the Charleville area. Sometimes the four kinds were found in the one paddock. The great bulk of the Mitchell grasses seen by Mr. Tannock and myself on the downs and plain country of the Charleville district consisted of Curly Mitchell. The other three kinds formed only a very small proportion of the Mitchell grasses seen in the area.

In one instance a considerable portion of a plain occupied by Barley Mitchell was pointed out to us as consisting originally of clay pan. It was explained to us that sheep first introduced the seed on to the clay pan and tramped it in. Later germination of the seed took place and the grass eventually spread and formed almost a pure stand of this species.

III. Characteristics of the Mitchell Grasses.

The Mitchell grasses are perennials. They commonly grow in tufts or tussocks (see Plates 121, 122, and 123). Although the following observations particularly apply to Curly Mitchell grass, they are also true to a certain extent of the other kinds.

The tufts or tussocks of Curly Mitchell grass vary considerably in size. When large they often exceed one foot across and sometimes consist of over 100 stems. In densely grassed country the tufts or tussocks of the grass are close to each other. In thinly and sparsely grassed areas the tussocks are generally distantly spread, say, from 6 feet between tussocks.

The stems are upright or nearly so at the base and arise from a hardened, creeping root-stock which is mostly situated beneath the surface of the soil. The stems are firm or even hard. The leaves are also firm in texture, and, so far as I have observed, they lack the succulence which is a feature of many valuable Australian grasses of a softer character such as Shot grass (*Paspalidium globoideum*), Dairy grass (*Eriochloa* sp.), &c. These two soft-textured grasses occur in the Charleville district and are referred to in a later part of this report.

Plate 123.

Excavating and examining the roots of Curly Mitchell Grass (*Astrebla lappacea*) on black-soil downs at Oakwood, about 60 miles north of Charleville. The picture shows a pure stand of the grass. Messrs. Willis, Tannock, and White in picture.

The lack of succulence in mature Mitchell grasses probably contributes to their durability, which is one of their most conspicuous and valuable economic features.

The root-stock of the Mitchell grasses is of great importance when considering the persistence of these grasses through periods of drought and constant grazing by stock. The strongly perennial character of these grasses is due to the durable and life-retaining character of the root-stock. The life-retaining properties of the root-stock are due in some measure to the hardened character of its tissues and to the sheathing scales enveloping it. The root-stock branches freely and mostly measures $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter. The direction and extent of its growth determines the shape at ground level of the tufts of stems or tussocks. Large numbers of robust roots spring from the root-stock and pass downwards into the soil. By means of this strongly developed system of roots penetrating downwards for several feet into the soil, these grasses draw upon the last reserves of soil moisture and persist through dry weather and hardship.

The depth of soil penetration by the roots of the Curly Mitchell grass was studied on black-soil downs country north of Charleville (see Plate 123). It was found by digging that the roots terminated at a depth of 4 feet from the soil surface. At this depth the texture of the soil appeared to be still favourable for soil penetration. It did not appear that the soil texture formed any obstacle to further penetration by the roots. The roots for the first 2 feet were strong and hard and apparently of a texture similar to that of the root-stock. From 2 feet downwards the diminution in size and hardness was noticeable. The very small roots found from the 2-feet level down to 4 feet were often flattened in shape and easily broken.

For the determination of the depth of root penetration an especially large tussock of the grass was chosen. The large size of the tussock is an indication of considerable age.

I have heard and, I think, read statements to the effect that Mitchell grass penetrates the soil to a depth of 20 feet. So far I have not met anyone who has personally observed such a great depth of soil penetration by this grass.

IV. Mitchell and Flinders Grasses Compared.

In several of their characteristics the Mitchell grasses are strongly contrasted with the Flinders grasses. The common kind of Flinders grass in the area covered by Mr. Tannock and myself in the Charleville district is *Iseilema membranacea* (*Iseilema actinostachys*). The annual character of this grass is strongly emphasised. Its roots are mostly only a few inches long and rarely appear to attain as much as 1 foot in length. It is readily pulled up. If often seeds when very small. One plant in full seed only measured $2\frac{5}{8}$ inches in length, including seed-heads and leaves. It is a fragile plant which readily breaks up and is blown about or falls on the ground. The dismembered and broken parts of Flinders grass when blown into hollows and when lying on the ground are reported to provide much forage which is appreciated by stock. With the advent of rain, however, it soon decays and is lost to stock at least for a season. In texture it is much softer than the Mitchell grasses and is often reputed to be more palatable. As a matter of fact, many graziers state that their stock eat many other grasses and many herbs in preference to the Mitchell grasses. However, the durable and perennial character of the Mitchell grasses, combined with their nutritive properties, gives them pride of place far above all other forage plants in the wide areas in which they are dominant.

Many graziers report an increase of Flinders grass in their localities during the present season. Mr. Tannock and I saw pure stands of this grass in some places, but pastures composed almost solely of it were not common.

V. Mitchell Grasses and their Resistance to Drought and Stock.

There can be no doubt that the Mitchell grasses, through their peculiar structure, texture, and other intrinsic properties, are extraordinarily resistant to drought and continued stocking. When considering this resistance attention is directed to the behaviour of the root-stock. The root-stock's life-retaining capacity is an exceedingly important factor in the survival of the grass.

During periods of drought in areas which have been heavily stocked the stubble of the Mitchell grass tussocks is often visible. Frequently it is bleached or at times it becomes darkened. We were often told that stock in dry seasons paw the ground to unearth the root-stocks, which they eat.

The question as to whether Mitchell grasses are diminishing was discussed with many pastoralists, drovers, and stockmen. Opinions on this subject are conflicting. Those who maintain that there is no thinning out of the Mitchell grasses state that they are just as prevalent now as they were in the past. Some of the men who discussed the matter with Mr. Tannock and myself stated that late summer rains are required for the growth of Mitchell grasses, that early rains, say, in the spring, bring up large quantities of herbage and these prevent the Mitchell grasses coming through later on in the season if rain falls. One grazier stated that he had observed that the root-stock of Mitchell grasses responded to both early and late summer rains, and that the seed germinated only with late summer rains. In some cases it was stated that Mitchell grasses had increased on some properties. A large proportion of those who contend that the grasses are not decreasing were connected with properties which had been lightly stocked or at least not overstocked. Those of the opposite opinion state that there is a noticeable diminution in the Mitchell grasses in areas which have been heavily stocked over a long period of years.

There were at least four experienced men who stated that horses are very severe on the Mitchell grasses. According to thir observations, horses are especially fond of the seed-heads, and when the grasses are in seed they regularly eat off the seed-heads. On this account, we were told, the horse paddocks of pastoral properties are often to be distinguished from other paddocks by the scarcity or shortness of the Mitchell grasses.

VI. The Past and Present Condition of the Ward Plain.

The part of the Ward Plain with which we are particularly concerned is about 10-12 miles in a north-westerly direction from Charleville. The stock route traversing the plain is from 1 to 2 miles wide in this locality.

From the fact that it is close to Charleville and is open to travelling stock, the stock-route portion of the plain has been very closely grazed over for a long period of years. The dominant plants on it to-day are salt weeds and small burr plants such as *Threlkeldia proceriflora, Bassia echinopsila, Bassia anisacanthoides,* and *Atriplex Muelleri.* At the time of our visit (March) there was a small amount of Flinders grass (*Iseilema membranacea*) and Curly Mitchell grass (*Astrebla lappacea*). All of these plants are native species (see Plate 124).

In the course of inquiries Mr. Tannock and I were able to ascertain from an authentic source that Mitchell grasses were very plentiful on this area thirty to forty years ago. This information was corroborated by a statement from an independent source. We were informed that about forty years ago the Mitchell grasses were so thick that they were readily mown down with a scythe, and the cut grass was taken in a cart to Charleville and sold.

Since that time the Ward Plain has undergone a great change. The Mitchell grasses are certainly far from common there now. In many parts of the plain these grasses are now absent or very rare.

We were informed that Mitchell grasses have not been plentiful on the Ward Plain for twenty years.

The stock-route portion of the Ward Plain is probably an extreme example of severe over-stocking over an extended period.

PLATE 124.

The stock route on the Ward Plain, about 12 miles north-west of Charleville. The vegetation shown in the foreground consists of low-growing Salt Weed (*Threlkeldia procoriflora*) and two low-growing burr-bearing plants (*Bassia echinopsila* and *B. anisacanthoides*). Mr. Tannock in picture.

VII. Are the Mitchell Grasses Diminishing?

From the examples of the destructive effects of horses which were shown to us and from the present condition of the stock route on the Ward Plain, it appears to us that Mitchell grasses are destroyed by continuous overstocking over an extended period of years, including drought years. In view of this conclusion we are of the opinion that at least some of the reports as to the diminution of Mitchell grasses in heavily overstocked areas are correct. With continuous overstocking and the incidence of droughts the root-stocks of the Mitchell grasses tend to die out. The dead root-stocks when dug up crumble rapidly to a powder in the fingers.

As suggested by some of the pastoralists, it is very desirable where possible to allow the Mitchell grasses to seed freely. We were informed that this practice is carried out by some pastoralists. The desirability of not overstocking is too obvious to need any special mention. It must, too, be recognised that there may be many cases where economic conditions will not allow of the execution of desirable precautions aimed at the maintenance and spread of the Mitchell grasses.

From the information we collected and from reports sent to the Government Botanist it is evident that the diminution in the Mitchell grasses is not confined to any one State or to any particular district. On the other hand, it should not be inferred from these remarks that the diminution is general. Many of the holdings seen by Mr. Tannock and myself were heavily grassed, and there were no reasons to believe that damage of any kind had been done to the grasses.

Apart from the statement that Mitchell grasses germinate with summer and late summer rains, we were not able to ascertain much information about the germination of the seed. We were informed that young seedlings resulting from germination brought on by one fall of rain were sometimes destroyed by hot, dry weather. In another quarter we were informed that the young seedlings are often pulled out by grazing stock.

VIII. The Rainfall and its Effect.

At least two men connected with stations claimed that there has been a decided shortage in the rainfall during the past few years. According to these men this shortage of rain, as well as overstocking, has contributed to the diminution of Mitchell grasses in some areas. One of these men, when asked how he arrived at the conclusion as to a shortage of rain, replied that considerably larger quantities of water had to be supplied to stock in recent years than in earlier years. He was further of the opinion that on account of the shrinkage in rainfall the soil-moisture level had retreated downwards, and in many cases the Mitchell grass roots had been unable to attain this moisture level and the grass died in consequence.

We heard indirectly that the statement has been made by some of the very early residents that the rainfall was much heavier in the very early days of settlement, because sheep thrived without artificial supplies of water in areas in which this would be impossible now. This circumstance is mentioned because it may possibly be of some interest in view of the rainfall figures given below, especially those of the decade 1893-1884. In this decade the rainfall was considerably above the average.

In view of the above statements as to the alleged shortage of rainfall in recent years, a visit was paid to the Divisional Meteorological Bureau, Brisbane. There I interviewed Mr. Hartshorn, First Meterological Assistant. In reply to my inquiries Mr. Hartshorn informed me that he was not aware of any decrease in western rainfalls, but kindly gave me access to the official records and much valuable assistance. With the records at hand the average rainfall was computed for each decade dating backwards into the past from the end of 1933. Thus the first decade begins with 31st December, 1933, and ends with the 1st January, 1924. The following table shows the results:—

Station.	General Average.	Average 1933-1924.	Average 1923-1914.	Average 1913-1904.	Average 1903-1894.	Average 1893-1884.
Charleville ..	19·59	17·62	19·28	20·87	17·05	23·32
Cunnamulla	14·24	12·80	13·80	13·35	11·23	18·12
Tambo ..	21·44	19·61	21·0	23·12	17·66	Incomplete
Eulo	11·96	10·44	12·26	10·73	10·24	Incomplete
Hungerford	11·09	9·04	10·0	10·89	10·56	15·22
Morven ..	21·63	22·03	21·37	22·64	17·39	Incomplete

From the above table it is seen that there has been a considerable diminution in the rainfalls of Charleville, Cunnamulla, Eulo, Hungerford, and Tambo. Morven is exceptional, as there has been an increase over the general average during the decade just passed. Morven is nearer to the east than the other stations, and meteorological influences other than those at the other recording stations may operate there.

Considering the first decade dating back from 1933, the percentage diminution of rainfall from the general average has been 10 per cent. at Charleville and Cunnamulla, 12½ per cent. at Eulo, 18 per cent. at Hungerford, and 8½ per cent. at Tambo.

Bearing in mind that these percentages diminutions are spread over a period of ten years, it would appear that they represent a considerable shortage of rain. It is quite feasible, then, that this shortage has adversely affected the Mitchell grasses in common with other vegetation.

The rainfall averages for the decade 1903-1894 show a very dry period at all stations, and the figures in the table can be compared with those of the decade just passed (1933-1924).

Some interest also attaches to the figures for 1893-1884, where they are available. The figures here are encouragingly high. They are encouraging because they suggest that such seasons may recur. One naturally asks if this decade represented the seasons of plenitude in which old residents claim that artificially supplied water was not required in certain localities.

IX. Suggested Tests and Experiments.

It is very desirable to obtain accurate information on at least two points. The response of overstocked areas to the removal of stock from them for varying periods of time is one important point. Another subject which should amply repay investigation is the germinating properties of Mitchell grass seed. The seed of Curly Mitchell grass is referred to here. With accurate information concerning the germination of the seed, some productive and readily applied method of pasture treatment may be arrived at. The fact that much of the western areas during severe drought periods appears bare and after rain is transformed into wide expanses of luxuriant vegetation indicates that seeds play an exceptionally important part in carrying different species of plants through dry periods.

Possibly there are peculiarities in the germination of Mitchell grass seed which may be utilised in spreading the species. In any case it is as well to ascertain how long the seed is likely to last in the soil.

It is suggested that a quantity of Mitchell grass seed be obtained and stored in suitable receptacles at Charleville. The seed could be left in charge of Mr. E. J. Tannock, the District Inspector of Stock. A certain number of the seeds could be tested each year by the Pure Seeds Branch of the Department of Agriculture and Stock. In this way it could be ascertained if there are any peculiarities with respect to germination and age in the seeds.

The stock-route portion of the Ward Plain would provide a suitable area on which to study the effect of closing an area to stock. If it is practicable to keep stock off a small portion, say, 20 acres, of this area, the progress of the Mitchell grasses on it could be observed. We

discussed this matter with some of the pastoralists of Charleville. They unanimously agreed that it would be extremely interesting to carry such a plan into effect. The difficulty of keeping the area, when it is fenced, free of stock was emphasised. After the area has been shut up for some time the fresh feed in it will constitute a considerable temptation, and the fence may be cut to allow hungry stock into the fresh feed. However, this difficulty may not be insurmountable. If this Department, with the sanction of the Department of Public Lands, decides to make this trial, Mr. E. J. Tannock, District Inspector of Stock, in co-operation with the Warrego Shire Council, may be able to devise some means of keeping stock off the preserved area. If it is found impracticable to close off a portion of the stock route on the Ward Plain, perhaps some other closely eaten-over area could be treated. In that event it would be necessary to ensure that the chosen area had been Mitchell grass country.

Once a suitable area is secured against invasion by stock the progress of the grasses and other vegetation could be carefully studied. As soon as the area is shut off a botanical survey of it should be made. Chosen areas could be photographed with a large-sized camera in order to show the aspect and distribution of the various grasses and plants. This photographic work could be effectively carried out by the Government Photographer attached to the Department of Agriculture and Stock. The botanical surveys and photographic studies could be made at suitable intervals so that permanent records could be made of the changes brought about by the absence of stock. By such means as these considerable light may be thrown on the problem of regeneration of Mitchell grasses. It is quite possible, too, that some of the results accruing from the fenced-off area may be correlated with laboratory germination tests of the seed.

As already mentioned, two burr-bearing plants (*Bassia echinopsila* and *Bassia anisacanthoides*) are very common constituents of the vegetation of the Ward Plain. The fencing-off trial may possibly indicate some means of controlling the spread of these and allied plants, such as the Galvanised Burr (*Bassia Birchii*).

In view of the remarks under the section "Rainfall and its Effect," it is clear that data on the distribution of soil moisture may prove to be valuable. Especially is it desirable to obtain information concerning the moisture at various levels in the soil from the surface down to about 4 feet. The growth rate of the Mitchell grasses and other plants may be found to be correlated with certain percentage distributions of moisture at various soil depths. The Agricultural Chemist could be asked to furnish further details on this point. Naturally it would be most desirable that such moisture determinations should be carried out periodically on the fenced-off plot already referred to. If soil moisture determinations are to be made at the proposed observation plot, it would naturally be advantageous to have a rain gauge on the area and keep records of the rainfalls.

X. Some Grasses Associated with Mitchell Grasses.

Blue grass (*Dichanthium sericeum*) is common in some parts, especially to the north-east of Charleville. We were informed by the manager of a large station that Blue grass is brought on by early rains, say, November to January; that rains in March and April favour

Mitchell grasses; that when Blue grass is heavy there is less Mitchell; that when Blue grass is light there is a heavier growth of Mitchell; and that there was more Mitchell on his holding during the last three years than before.

It may be worth mentioning here that we were informed that some of the older residents of the country north of Charleville state that Blue grass once covered the country now occupied by the Mitchell grasses. We heard this of more than one area north of Charleville, but the statements in each case only reached us indirectly. If observations in the future indicate that there are more or less marked successions or cycles of vegetation in certain areas, these statements concerning the prevalence of Blue grass in the past may prove of interest. Blue grass has a good reputation, but does not appear to have the durable properties of the Mitchell grasses, as according to reports it appears to be more susceptible to disruption and decay.

PLATE 125.

Brown-top Grass (*Eulalia fulva*) on plain at Wallal, 12 miles south of Charleville. The dark streaks represent the brown seed-heads of the grass.

Brown Top was met with occasionally in Mitchell grass country. This grass is sometimes locally known as Brown-top Blue grass. It is referred to by botanists as *Eulalia fulva*. It was most commonly found on low-lying ground. Occasionally it was interspersed with Bull Mitchell. The leaves and stems are mostly greyish green or reddish in colour. That it is palatable in western areas is evident from the way it is eaten down by stock (see Plate 125).

A tall Rat's Tail grass (*Thellungia advena*) was often seen in the Mitchell grass country. This is a tough grass which grows in tussocks. The leaves at the base of the stem were often eaten off, indicating that it provides some feed for stock. Another grass with a scattered distribution in Mitchell grass country is Early Spring grass or Dairy grass (*Eriochloa* sp.). This is a fairly succulent grass with a high reputation for palatability. Shot grass (*Paspalidium globoideum*) was less frequent than the two preceding species. It was seen chiefly in damp

places and along bore drains. Its name is derived from the resemblance of its seed to shot. It is a succulent grass with a high reputation for palatability.

Plate 126.

Mulga country, about 6 miles south of Charleville. The trees shown are Mulgas (*Acacia aneura*). The leaves and shoots of the Mulga are readily eaten by stock. This type of country is a very valuable standby in droughts.

Acknowledgments.

The writer is especially indebted to Mr. E. J. Tannock, District Inspector of Stock, for his very able co-operation in all the field work. Several questions were discussed with Mr. C. T. White, Government Botanist, and his assistance is gratefully acknowledged. To all of those who so kindly extended hospitality to us and to those who unreservedly placed their experience at our disposal cordial acknowledgment is expressed.

Note.—*Part II. of this article will appear in the April "Agricultural Journal."*

Mammitis.

By K. S. McINTOSH, B.V.Sc., H.D.A., Veterinary Officer (Animal Health Station).

MAMMITIS or, as it is sometimes called, mastitis, is a disease of the udder of cows and is well known to many dairy men throughout Australia, and practically all other countries in the world.

The annual economic loss caused by this disease by diminished milk production is difficult to estimate, but judging by its prevalence must be enormous.

To appreciate the explanation of the disease we must first consider the structure of the normal udder. The udder consists of two large milk secreting glands which lie side by side and are separated by a distinct wall or septum. Each of these glands is again divided into two separate portions, and thus the udder consists of four quarters.

If we examine a portion of the gland substance of the udder under the microscope, we find that it is composed of tiny chambers which empty by means of minute tubes. It is in these chambers that the milk is manufactured and then drained away by means of the minute tubes. The tubes pass downwards and are jointed by many others forming larger ones, which eventually empty into a milk cistern or reservoir, one of which is situated at the upper end of each teat.

From the milk cistern a wide milk duct or teat canal passes down the centre of each teat to its external opening. This opening is normally closed by a circular muscle, except, of course, during the process of milking when pressure is exerted by the hands to force the milk through. The udder is thus a complicated and delicate arrangement of glands and their corresponding milk tubes. The whole of these structures is supported by a delicate framework of connective tissue and supplied with nourishment by innumerable tiny blood vessels.

Mammitis simply means inflammation of the udder. Apart from wounds and bruises, there are several diseases which cause inflammation of the udder, including tuberculosis, actinomycosis, contagious mammitis, and acute non-specific mammitis.

In these notes the two usual forms—contagious mammitis and acute non-specific mammitis—will be dealt with.

Contagious Mammitis.

Contagious mammitis is a chronic inflammation of the udder caused by one of several special kinds of germ, the commonest being Streptococcus of mammitis.

Although this germ grows best in the udder of a cow, it also lives for long periods in dust, &c., particularly if it is not exposed to the action of disinfectants or sunlight. It is conveyed from one cow to another by the hands of milkers, by milking machines or by contaminated dust. Having gained entrance to the teat canal, the germ does not take long to invade the remainder of that quarter of the udder, establish itself by rapid multiplication and set up a chronic type of inflammation.

The first symptom of inflammation may be a pinkish tint in the milk, due to the presence of blood; or the milk may be reduced in

quantity and altered in appearance. Often there is a secretion of watery fluid containing small yellowish particles of pus. Later nothing but thick yellow pus can be milked from the affected part.

One or more quarters may become affected, and as the disease progresses the gland tissue is destroyed and replaced by an overgrowth of the fibrous tissue framework of the udder. The normal udder has a soft flabby feel when empty, but the udder affected with old-standing mammitis has a hard lumpy or knotty texture due to old abscesses and masses of fibrous tissue.

In time, perhaps, when the cow is dried off, the affected quarter or quarters partially or completely cease to function.

The disease is slow and insidious in its progress, often leading the farmer to believe that the cow is only suffering from a chill, the result being that it may be well established in the herd before the seriousness of the position is realised.

Prevention.

The main thing to bear in mind is that the disease is contagious, so, firstly, be extremely careful when purchasing a cow to avoid introducing the disease into the herd. Care should be taken to examine the udder and milk, and to obtain a reliable history regarding the health of the rest of the herd from which she comes.

A handy method of examining the milk is to strain it as it is drawn through a piece of black cloth. This will enable you to detect any small clots or pieces of pus.

Once the disease is discovered in the herd, isolate the affected cows by running them in a separate paddock and milk them after the balance of the herd is finished.

Do not milk pus, &c., on to the floor of the bails, as in this way the germs contaminate dust and spread the disease. All abnormal milk and pus should be stripped into a bucket or kerosene tin containing disinfectant and later disposed of by burying.

Wash the hands thoroughly and dry them on a clean towel after milking each cow. Wash the teats and udder of the cow before milking in a clean weak solution of Condy's crystals.

Treatment.

The next thing to consider is treatment. This consists of general, local, and inoculation.

By general treatment is meant keeping the cow in good general health by proper feeding and, if necessary, rugging her during cold weather; also give her a dose of 10 ounces of Epsom salts and 2 ounces of ginger. This will assist her to eliminate any poisons which she has absorbed from the diseased udder.

The local treatment consists of stripping the cow thoroughly at least three times per day; oftener if possible. During and after the stripping the udder should be massaged with some mild liniment such as soap liniment. The object of this is to press as much pus as possible from the gland substance and remove it by stripping. In other words, it is an attempt to drain the pus from the udder.

Vaccination.

Vaccination is the injection under the skin of the animal of an enormous number of dead germs of the same type as those which cause the disease.

As the germs are dead they cannot set up an attack of the disease, but they can and do stimulate the production of defensive substances in the tissues of the animal which if sufficiently strong will control the infection in the udder.

The ideal vaccine to use is one which is made from the animal or herd which is to be treated. To do this a clean bottle is boiled and corked to kill any germs which may already be in it. The affected teat is then carefully washed and dried and the first squirt of milk expressed. The sample taken should consist of the second, third, and last squirts of milk.

At the Animal Health Station, Yeerongpilly, numerous vaccines are made throughout the year for various stockowners, and the procedure is somewhat like this:—

A bottle of milk from a suspected cow is received and examined to determine what disease producing germs it contains. A small quantity is then sown on culture media on which the germs grow. Quite a number of colonies appear after twenty-four hours, but the ones which cause mammitis are recognised by their appearance.

These particular colonies are then carefully removed by means of a sterilised needle and grown in sterilised broth for forty-eight hours. After this time a small quantity of antiseptic is added which soon kills the germs.

This now constitutes the crude vaccine which is ready for use after it has been standardised and tested in various ways to make sure it will be effective but not harmful in any way to the animal.

Vaccine treatment strikes at the very root of the trouble, but it must not be regarded as a miracle which will obviate any necessity for the prevention and other general and local treatment which has already been dealt with. It is an extremely useful method of preventing animals from contracting the disease, and is also a curative in larger doses.

To obtain some record of its effectiveness in the field, farmers were asked to comment on their experience with its use. In practically all cases where the vaccine was used properly very favourable reports came to hand.

For many years vendors of proprietary medicines have been selling substances to inject into the udder to cure mammitis. We have already noted the extreme complexity and delicacy of the udder tissue, and from this it can easily be realised that it is practically impossible to reach the small milk manufacturing chambers high up in the udder with any antiseptic. In addition, most antiseptics which would kill the mammitis germs would also destroy the milk secreting glands of the udder. Thus the Department cannot as yet recommend any of these udder injections for the treatment of mammitis.

Non-specific Acute Mammitis.

This form of mammitis is not caused by any particular germ, but rather by invasion of the udder by numerous types.

It is commonly seen soon after calving, after the use of a dirty or non-sterilised milking tube, or after injury, exposure to cold and wet, &c.

First, the udder becomes inflamed, enlarged, hot, and painful. The flow of milk practically ceases, the cow goes off her feed.

Treatment should be adopted as soon as the case is noticed. Give the cow 1 lb. of Epsom salts and 2 ounces of ginger in a quart of water.

The udder should be bathed and stripped out every two hours and the cow kept in a dry comfortable stall or paddock. At each stripping when the inflammation and pain has subsided somewhat the udder should be massaged, but not vigorously enough to cause unnecessary pain. Any abscesses which form on the surface of the udder should be opened and flushed out with weak antiseptic.

With this form of mammitis, treatment must be thorough and energetic, otherwise the cow may lose one or more quarters or, perhaps, even die.

TANNING FUR SKINS.

"Lightning" Process and the Wattle Bark Method.

The "Agricultural Gazette" of New South Wales, in discussing recipes for tanning fur skins, says that the "lightning process" is much quicker than wattle-bark tanning but, while quite effective, is not as good as the latter method.

THE "LIGHTNING" PROCESS.—Cut off the useless parts of the skin and then soften it by soaking, so that all flesh and fat may be scraped from the inside with a blunt knife. Soak the skin next in warm water for an hour, and during that time mix equal quantities of borax, saltpetre, and Glauber salts with enough water to make a thin paste. About half an ounce of each ingredient will give enough for a small skin, and proportionately more will be required for larger ones. When the skin has soaked in the warm water, lift it and spread it out flat, so that the paste may be applied with a brush to the inside of the skin; more paste will be required where the skin is thick than where it is thin. Double the skin together, flesh side inwards, and place it in a cool place for twenty-four hours, at the end of which time it should be washed clean and treated in the same way as before with a mixture of 1 oz. sodium carbonate (washing soda), ½ oz. borax, and 2 oz. hard white soap; these must be melted together slowly without being allowed to boil. The skin should then be folded together again and put in a warm place for twenty-four hours. After this, dissolve 4 oz. alum, 8 oz. salt, and 2 oz. sodium bicarbonate (baking soda) in sufficient hot water to saturate the skin; the water used should be soft, preferably rain water. When this is cool enough not to scald the hands, the skin should be immersed and left for twelve hours; then wring it out and hang it up to dry. The soaking and drying must be repeated two or three times, till the skin is soft and pliable, after which it may be rubbed smooth with fine sandpaper and pumice-stone.

WATTLE-BARK TANNING.—The second method, in which wattle-bark is the tanning agent, though not so quickly accomplished, should give better results.

Collect some wattle-bark and make a strong decoction by boiling or steeping the bark in water. A bushel of crushed bark from a tannery, if one is near at hand, will be found an easy way of getting the best bark. The skin should be scraped clean on the inside, as in the "lightning" process, before steeping begins. It is best to let the skin lie as flat as possible while soaking; and a large, square, zinc-lined packing-case is therefore preferable to a barrel. The skins should be completely covered by the liquid, which must either be changed once a week or boiled anew and skimmed. While the skin is out of the liquid each week it should be lightly scraped. Large skins take up to six weeks to tan well, but small skins will not require more than a month.

Use and Care of Milking Machines.

IT frequently comes to the notice of the Department that milking machines are discarded by dairy farmers allegedly owing to the production of lower-grade cream. It is generally found, however, that lack of suitable attention on the part of the dairy farmer is the primary cause. As the milking machine is one of the greatest factors in dairying economics, the following instructions in regard to their use and care are re-issued.

With proper care and attention to cleanliness machines will deliver first-class produce.

Milking.

Keep the milking shed, yards, and surroundings in a clean, sanitary condition. Wash the cows' teats in clean water, and draw milk from each teat and ascertain if the milk is normal before putting on the teat cups. To place the teat cups in position bend them all down except the one you are going to attach to the teat; attach each cup in like manner. When the cups are all attached and the milking is proceeding satisfactorily, do not interfere with the machines until the cow is milked out. See that no air enters the cups and destroys the vacuum; this defect is indicated by a hissing sound caused by the air rushing into the cups.

Should a cup fall off the teats give it immediate attention, as the suction will draw dust and particles of dirt into the system and contaminate the milk.

The cleansing of the milking machines is one of the most important parts of the dairyman's operations. Failure to thoroughly wash and properly cleanse the plant after each milking will result in the production of low-grade milk, cream, and dairy products.

Cleansing the Machines.

After completion of milking do not delay in carrying out this important work, which will, if properly performed, materially assist in producing high-grade milk.

Turn off the air tap in each bail. Start at the end bail and clean adhering particles of dirt from the outside of the cups and claws so as to prevent the dirt entering the flushing water. Then thoroughly flush each unit in turn by drawing through it at least half a bucket of cold water, dipping the cups in and out of the water so as to draw in air during the flushing. A thorough flushing out with cold water will remove traces of milk from the rubber teat cups, pipes, releaser, &c. Always use cold water for this flushing. On no account should hot water be used, as it will tend to cause casein to become caked on the inside of the pipes. Scalding water at a temperature of at least 180 deg. Fahr., to which may be added one tablespoonful of washing soda to every 2 gallons, should then be drawn through the cups and pipes, care being taken to admit the water slowly at first in order to gradually heat the sight glass so as to prevent its breakage. Thoroughly clean the milk pipe line by means of the brush supplied with the machine, and according to instructions. The air pipes and vacuum tank, which frequently become foul owing to milk vapours entering and condensing in them, should be regularly cleansed and sterilised with boiling water. With

machines in which water can be drawn through the air pipes by means of the vacuum pump, care should be taken not to flood the vacuum pan, thereby causing the water to get into the pump. The sterilisation of dairy appliances and equipment is most effectively and economically done by boiling water, and where it can be utilised nothing is usually gained by the addition of chemical disinfectants. When the cleansing of the piping is completed, open all taps and leave the pump running for a few minutes to dry out the pipe line. This assists in keeping the plant in a sanitary condition. Leave all pipes open when the plant is not in use, so as to allow the air to circulate through the system. The releaser should be detached, thoroughly cleansed, and allowed to dry.

Cleansing the Teat Cups.

When the flushing out of the machine as described has been completed, remove the teat cups and rubber connections. Dissemble the cups, and carefully brush the cups and claws with a dairy scrubbing brush. This should be done in hot water in which soda or a cleansing powder has been dissolved. It is essential to remove all grease in the first flushing and to then brush and cleanse the rubbers. If the rubber inflations have not been thoroughly cleansed they will be sticky to the touch, which is an indication of a film of grease on the rubber. The surface of a well-cleansed rubber will cling when the finger is rubbed along it. Careless cleansing will allow the grease to penetrate the surface of the rubber to the extent that it cannot be scoured out, and the rubber will perish. Rubbers so affected should be discarded. Careless cleansing of the inside of the teat cup cases gives rise to corrosion and pitting of the surface. Where cups have screw caps the cleansing of the threads should receive attention, and a slight smear of vaseline applied to threaded parts will assist in keeping them in good order. The dissembling and cleansing of cups and claws should be done as frequently as possible and not less than three times a week.

Cups and rubbers, after being cleansed, may be either left in an antiseptic solution or may be dipped in same for fifteen to twenty minutes, then removed and placed in a suitable receptacle in a cool place, away from the light, and protected from flies and dust. The vessel in which the disinfecting solution is held must be large enough to allow of the teat cups and rubbers being immersed in the solution without doubling the rubber tubes in a manner to prevent the complete displacement of air by the disinfecting solution.

Several solutions for dipping or soaking the cups and rubbers are recommended by manufacturers of the different milking plants, and include chlorine compounds, lime water and permanganate of potash, and brine solutions.

Special attention is drawn to the necessity of removing all traces of the solution that may be used for the sterilisation of the cups, rubbers, pipes, &c., that come in contact with milk, before the machine is again used. This is done by flushing each unit with sufficient hot water to effectively remove any trace of the solution before commencing to milk.

Many dairymen object to very hot water for cleansing rubber, believing that the rubber is destroyed. The judicious use of hot water will do no harm to rubber, provided that all grease is removed from the rubber before the hot water is applied. Rubber, if kept in water for ten to twenty minutes at a temperature of 165 to 175 deg., will be

unharmed by the heat, and most bacteria which detrimentally affect milk will be destroyed. If the rubber is placed in water at a temperature of from 180 to 190 deg. Fahr. long enough only for the surface of the rubber to be heated to the same temperature, the same object will be attained without injury to the rubber.

Lime a Suitable Disinfectant.

An efficient disinfecting solution is made by adding 2 lb. of quicklime to 10 gallons of water. Stir well and allow the solution to settle. Pour off the clear liquid and immerse teat cups and rubbers in it for a period of fifteen to twenty minutes.

MEN OF THE TREES.

PRESERVING A HERITAGE.

In an age when man's hand is tireless in despoiling nature, it is no small comfort to find that there is still a minority who think as R. L. Stevenson always thought, that "trees are the most civil society." Progress, mingling brutality with idealism, has denuded many countries of their forests, and of all countries England would seem to have suffered most. Vast tracts of her beautiful landscape have been ravished and lie under grass, with only an occasional tree to remind us of forgotten woods and glades. Millions of trees have been destroyed needlessly—millions could be planted again as an asset both to beauty and national wealth. And that is where "The Men of the Trees" hope to assert their influence.

"The Men of the Trees" is the picturesque name given to a voluntary society in England founded ten years ago by Mr. Richard St. Barbe Baker. Its aim, tersely expressed, is to develop a tree sense in every citizen, and to encourage all to plant, protect, and love trees everywhere. "What concerns us as Men of the Trees," says that society, "is that our country is being deprived of a permanent economic asset and the heritage of beauty which is characteristically British. Moreover, the continued destruction of trees cannot be disregarded, in view of the drought in many districts, and this drought is liable to become more serious unless remedial measures in the form of extensive reafforestation are put forward."

CULTIVATE A "TREE SENSE."

Though the exact relation of trees to rainfall is not easy to define, and may be treated as a subject of controversy, the principle may safely be laid down that forest areas lead to greater condensation both in the case of sea winds and the case of mountain mists. There is no doubt whatever that the climate of many rural localities in Britain has been gravely affected by the cutting down of forests and the failure to replace them. That much is to be admitted. But, apart altogether from that aspect of the question, the Men of the Trees are striving above everything to instil into the hearts of English people a "tree sense," which, once cultivated, will inevitably express itself in the transformation of the countryside. The society feels that everyone who plants trees is contributing a service to the nation, and for this reason should be assisted by relief from taxation. Woodlands which, for example, have been properly cared for by the owner or tenant, for life, should be exempt from death duties (these duties having levied a dreadful toll upon British forestry). Hundreds of great estates, thickly wooded for centuries, have been stripped of their timber in recent years to meet the demands of an inexorable and unimaginative Exchequer.

The society is constantly urging the planting of hedgerow trees and encouraging the planting of trees on a community basis. It is also offering prizes to schools for the best school plantation and organising arbor days and ceremonial tree plantings in memory of persons worthy of special honour. In addition it arranges periodical meetings, excursions, tree photographic exhibitions and competitions, lantern lectures, and parties for junior members. Expert advice on silviculture is given to all who ask for it, and several publications, including a highly artistic illustrated tree calendar, are regularly issued. Indeed, nothing that will assist in the attainment of its objectives is willingly left undone. First and last, the Men of the Trees are bent upon fulfilling the truth of Francis Thompson's noble words: "Thou can'st not stir a flower without troubling of a star."—J.R.W.T. in the "Sydney Morning Herald."

By H. W. BALL, Assistant Experimentalist.*

WHEAT has become the most important food of mankind, owing to its suitability for bread making, the simple cultivation required, and the crop's ready adaptability to differences of soil and climate.

The various forms and varieties of wheat are cultivated extensively in all agricultural countries with the exception of the more tropical regions, and it is interesting to know that wheat is being sown and harvested in one country or another the whole year round.

For most satisfactory growth, a cool moist growing season is required, followed by a bright dry ripening period of from six to eight weeks. In such favoured climates—Northern Europe and New Zealand provide examples—farmers secure an average yield of over 30 bushels per acre.

Wheat is the most important crop grown in Australia, being produced chiefly on those intercoastal areas having a rainfall of from 10 to 25 inches per annum. In Queensland, owing to its wider range of climatic conditions, and the diversity of its agriculture, wheat has not attained to the importance, relatively, that it has in the Southern States and Western Australia. Nevertheless, over 3,000,000 bushels from up to 300,000 acres of cultivation are produced annually in this State, although this quantity is not equal to Queensland requirements and has to be supplemented by Southern supplies.

On account of increasing consumption and seasonal variations, considerably more attention will have to be devoted to wheat growing before our State requirements are assured. Sufficient land is available, in the recognised wheat region, adjacent to the present railway system, and with the encouragement of payable prices, no other incentive would be necessary.

Value of the Industry.

Wheat growing already provides employment for over 3,000 farmers and their dependents, and also considerable employment in the transport, milling, and baking industries. Our record crop was produced

* In a broadcast address from A.B.C. Radio Station 4QG (Brisbane) and 4RK (Rockhampton).

in 1930—over 5,000,000 bushels, an average of over 18 bushels per acre. The average for the last ten years is over 14 bushels, and it is surprising to note that this exceeds the average of any mainland State in spite of the more capricious nature of our rainfall, only one-third of which falls during the growing period of the crop.

This higher average can largely be accounted for by the richness of the Queensland soils, especially those of the Darling Downs. Our climate also favours the production of superior, hard milling wheats of high gluten content.

The chief wheatgrowing centres in Queensland are Pittsworth, Allora, Clifton, Warwick, and Toowoomba, while some 20,000 acres are cropped in the Maranoa and a small area in the Dawson Valley and Central districts.

The largest individual areas are probably in the Pittsworth and Cecil Plains section, where endless seas of wheat present a most pleasing picture, especially during harvest when tractor-drawn header harvesters roar through the fields gathering hundreds of bags daily.

PLATE 127.—A FIELD OF PUSA WHEAT, WILLOWBURN HOSPITAL, TOOWOOMBA.

The Economic Position.

In recent years the price of wheat has fallen considerably in all countries, but the cost of land, machinery, and general necessities has not fallen to the same extent. Farmers, therefore, have need to consider ways and means of reducing their costs, in order to keep their business profitable. Increasing the yield per acre is an excellent way to accomplish this. If the standard of farming in every district could be raised to that of the most successful farmers, a considerable increase in acreage yields could be obtained. A study of cultural methods, soils, varieties, and seasonal variation will, therefore, help towards

the purpose in view. The essential points to observe will be outlined briefly.

Points in Field Practice.

As soon as possible after harvest it is advisable to burn the stubble, thus destroying fungous spores and putting the land in better condition for the first ploughing. This should be done when the land is neither too wet nor too dry, and should be not more than 4 to 5 inches deep, varying with the nature of the soil. This practice of early ploughing after harvest, and keeping the land free from weeds until sowing time, some four to five months, is termed summer fallowing, and is designed to conserve moisture for the use of the succeeding crop.

Plate 128.—A Fine Crop of Clarendon Wheat at Willowburn.

[*Photo.: Crook-King, Toowoomba.*

In the chief wheatgrowing States, the fallow period is much longer, being from nine to ten months, the land only producing one crop every two years. Under Queensland conditions, an occasional long fallow will be found useful in checking the spread of pests, such as wild oats. In some of the older settled districts long fallows, and the growing of fodder crops which can be grazed or cut before weed seeds mature are now becoming imperative, owing to the rapid spread of various weed pests. Sheep can be of great assistance in keeping the fallows clean, saving a considerable amount of cultivation, besides making good use of the weed growth.

Disc sundercut ploughs have become popular owing to their low cost of operation, but it is known that mould board ploughs will do better work on soil that is likely to break up too fine, and are also superior on land covered with weeds or rubbish.

Subsequent cultivation is best done with spring tooth or rigid tine cultivators and harrows, the object being to check weed growth, maintain a good mulch and bring about a desirable consolidation of the seedbed prior to sowing.

On certain free working soils a method known as ploughless tillage is being tried, whereby rigid tined cultivators are used in place of the plough or disc cultivator. Excellent results are being obtained, combined with greater speed and reduced cost of working. The seeding is generally done with a cultivator drill or combine, this implement being excellent for sowing on a surface that has set after rain, and also where slight weed growth is present.

PLATE 129.—A FIELD OF GLUYAS WHEAT AT WILLOWBURN.

[*Photo.: Crook-King, Toowoomba.*

When to Sow Wheat.

The time to sow varies with the season, and may extend from May to July. Some farmers commence sowing the slower maturing varieties such as Currawa and Cleveland in April, and subsequently feed off the early growth to sheep. Sowing on moisture is the ideal method, putting the grain not more than 2 inches deep. Where conditions are favourable it is advisable to hurry the seeding as much as possible before the moisture is lost, for rapid sowing after a favourable seasonal rain is one of the most important factors in securing a good yield, particularly in the drier areas. Should rains be delayed and the soil sufficiently dry, it is usual to go ahead with the drilling, leaving the seed to await favourable rains, but with this method there is always a risk of light showers malting the grain, necessitating resowing.

Varieties.

The farmer has a wide choice of varieties and must largely determine for himself those that best suit his particular soil and climate. It is better to grow two or three varieties, rather than concentrate on

one which may not suit all seasons. Generally speaking, the short season or early wheats are more suited to the hot inland districts such as the Maranoa; whereas where the growing period is longer, the slower maturing varieties are capable of producing a heavier yield. No variety may be said to be perfect or to suit all conditions, which justifies the continued efforts to produce more desirable types.

Rust is one of the chief problems in Queensland, where warm humid conditions as the crop approaches maturity will often induce a severe infestation. The attempt to evolve rust-resistant varieties has met with a measure of success in the production of "Three Seas" and "Seafoam," which are similar rust-resistant types. There are many other varieties in general cultivation, such as Florence, Clarendon, Pusa, and Flora, all of which have good characteristics, but which will doubtless be superseded in due course by improved types. To illustrate the effectiveness of the Agricultural Department's work in wheat improvement it may be mentioned that varieties bred by Mr. Soutter at the Roma Experiment Farm now constitute approximately 40 per cent. of the entire Queensland crop.

PLATE 130.—AN AUTO-HEADER HEAD ON.
Mechanised Agriculture has attained a high standard in Queensland.

The rate of seeding varies from 30 to 60 lb. per acre, depending on the district, the time of sowing, the character of the grain, the variety, and whether sown for hay or grain production.

Harvesting.

Header-harvesters are now in general use for harvesting, and in successfully gathering many storm lain crops they have saved the growers many thousands of pounds.

However, there is every incentive to speed up harvesting operations whenever suitably fine weather prevails. The early summer storms often coincide with the harvest period; and although the grain may

be gathered, there is some loss of grade by bleaching and weathering. Wheat farming machinery is expensive, and it is desirable to ascertain the most economical unit necessary to handle a certain area. It is obviously better business to work a plant to full capacity, although, owing to the speed usually necessary at seeding and harvesting times, there is a limit to the area which can be adequately worked by one set of implements. It is here that the tractor owner has a distinct advantage.

PLATE 131.—HARVESTING WHEAT IN QUEENSLAND—WHERE "TIME IS THE ESSENCE OF THE CONTRACT."

Wheatgrowing as a Business.

Considerable capital is required to commence a modern wheat farm when the cost of the land, improvements, machinery, sheep and living expenses for twelve months have to be provided for. However, reasonable terms can often be obtained on the purchase of land and machinery, while assistance is also given by the Agricultural Bank on the security of land and improvements. Also share farming can be undertaken by an experienced man with small capital.

Experimental work of assistance to the progressive wheat farmer would include accurate yield tests in the chief districts, rate of seeding tests, rotational trials, various methods of ploughing, cultivating, and rolling, the testing of long and short fallow periods, fertilizer tests on light or impoverished soils, determination of the costs of production with modern methods in the chief areas, also continued work in the breeding and selection of improved types.

As wheat is only one of many important crops raised in Queensland, we cannot hope to finance such extensive wheat research work as is carried out in the Southern States, where wheat is the major crop, but nevertheless the Department of Agriculture in Queensland has been of considerable service to the growers in the matter of breeding and introducing improved varieties.

The Queensland wheat industry has not progressed as rapidly as that of the Southern States and Western Australia, owing to land in the wheat belt being also admirably suited to general farming, dairying and sheep raising. This is obviously not to be deplored, for our farmers can alter their cropping system to meet changing economic conditions. The absence of any necessity to use fertilizer except on certain lighter

soils is also a distinct advantage, although this is offset to a certain extent by the heavier working of the Downs soils.

Plate 132.—Grain Ready for Gristing.
In the Wake of an Auto-Header on a Darling Downs Farm.

Finally, the Queensland wheatgrower has had the benefit of organised marketing in recent years, which has greatly assisted in stabilising the industry, for despite any criticism of the Wheat Board's activities, the growers themselves remain in control through their elected representatives, and can therefore direct the ultimate policy to be pursued.

SHIFTING FARM MACHINERY.

When it has to be done along metalled roads, wear and tear and shaking loose of bolts may be avoided if the travelling wheels are covered with old motor tyres. Cut the bead off before wrapping round the wheels, draw the edges together and fasten with fine wire, puncturing the holes with a bradawl. If the tyre is too large, cut a piece out and join neatly. A stripper working on stony ground will do smoother work shod in this way.

Fruitgrowing in North Queensland.

The Minister for Agriculture and Stock (Mr. Frank W. Bulcock) has received the following report on fruitgrowing in North Queensland from the Director of Fruit Culture (Mr. H. Barnes) :—

THE usual fine weather period has been experienced during the last quarter of 1934. Growing conditions during the early part of the quarter were excellent, warm weather being well interspersed with showers. December, however, was excessively hot and dry, and orchards suffered in consequence.

Rainfall at Cairns during the period was 126 points during October, 512 during November, and 145 during December, the number of wet days being respectively 6, 14, and 6, a total fall for the quarter of 783 points as against 2,409 for the same period of 1933.

Districts included in this report are Daintree, Mossman, Port Douglas, Bartle Frere, Innisfail, Silkwood, Cardwell, Herberton, Ravenshoe, Kuranda, and Cairns.

The various fruit crops throughout the North appear to have been affected by the adverse climatic conditions of the earlier part of the year. Crops of practically all varieties of fruits are somewhat patchy even on orchards in the same localities.

Tropical and Sub-tropical Fruits.

Citrus throughout the North is showing a fairly light crop, except in a very few orchards where medium to good crops are showing. The blossoming was very light and very protracted, resulting in the crops on individual trees showing a wide range of growth, odd fruits being near maturity while the remainder vary right down to young fruit little more than just formed. As a general rule the trees have made good growth during the period, this being particularly the case with young trees.

Bananas showed considerable improvement in the condition of plants during the quarter. The fruit, however, has not shown a corresponding improvement.

Fresh plantings have been made in various parts of the district to supply local demand.

Sugar bananas, whilst frequently producing heavy bunches of good fruit, are practically all affected with Panama disease.

Pineapples.—Harvesting of this crop, which commenced in the Cairns district in late October, was practically concluded by the end of the year. In districts south of Cairns the season is slightly later, and harvesting was still in progress at the end of the quarter. The fruit produced in Cairns was chiefly of small size, and the introduction of fresh vigorous stock appears desirable.

The variety grown is almost exclusively Common Rough, this being most favoured in the local trade. The inclusion of small areas of Smooth Leaf variety would be well worth consideration of Cairns growers to extend the season.

Papaws have been in fair supply and chiefly of fair quality. The demand has been good.

Mangoes carried a very fair crop in the Cairns district, this being occasioned by dry weather during the blossoming period. The crop in the Cardwell district, on the other hand, was light, rain falling there while the trees were blossoming.

Throughout the North the general quality of mangoes grown is not good, the bulk of the trees being ordinary seedling types. Only a few good varieties are to be found. Although top-working or budding of mango trees is not quite so easy as the working over of citrus trees, it will be necessary to so treat the many poor type trees if any market demand is to be established for this fruit. Districts such as Cardwell and Rollingstone are well adapted to mango-growing, and a few trees of selected varieties only would be a good commercial proposition to local landholders.

Deciduous Fruits and Grapes.

The plum crop on the Tablelands was this season a light one. The chief variety grown is a small early-ripening one known locally as "Precious," but bearing a close resemblance to "Wright's Early." Other varieties grown are "Satsuma," "Kelsey," "Blood," and odd "Shiro" and Wickson."

The quality of fruit produced is good, but unfortunately considerable loss is caused by fruit fly.

Plum trees, and, in fact, most deciduous varieties of fruits grown on the Tablelands, are raised from cuttings, which strike with remarkable ease and produce good trees.

Pears of "Keiffers" and "China" varieties are cropping fairly well.

The grape crop is only fair this season. "Goethe," "Isabella," and "Ferdinand de Lessop" varieties are showing the most promising results.

Persimmons are again carrying a good crop this year. The Tableland conditions appear to be well suited to the growth of this fruit.

Nuts.

Queensland nuts were very severely tested by the hot dry conditions of the latter part of the quarter. In very many cases along the coastal area the leaves were badly scorched and some trees were completely killed. Protection of young trees from the direct rays of the sun appears to be almost imperative with this nut.

Litchis.—The growing of these trees is slowly expanding. Unfortunately, young trees are not obtainable locally, but have to be imported from China, and this retards the expansion of their cultivation.

Tung Oil.—Fresh plantings have been made in various parts of the North, the area now under these trees being approximately 80 acres. The crop during the year was rather lighter than that obtained in the previous season.

Other Fruits and Vegetables.

The watermelon crop during the quarter was a good one, melons of very fine quality being produced during the early part of the season. The later-ripened fruit, however, was rather deficient in flavour. One grower in the Tully area reports having cleared £180 from a melon crop this season.

Small patches of strawberries on both the coast and the Tablelands have produced well.

Tomatoes gave promise of good returns, but a week of wet weather during the early part of the quarter caused an invasion of blight and black spot, which curtailed the crop. The Kennedy district (the largest tomato-producing area north of Townsville) shipped only about 4,000 cases on this account.

Beans and cabbages were produced in fair quantities on the Tablelands during the quarter and found a ready sale. Bean fly is, however, a serious pest.

FARMYARD MANURE—ESTIMATED VALUE TO THE FARMER.

Although there is no standard composition for dung, most farmers agree that the value of the heap depends largely on the amount of urine absorbed in it. Out of 100 parts nitrogen fed to a fattening bullock, 4 parts are retained in the system: 96 are excreted, and of these only 22 are in the solid excreta, while 74 parts are in the urine.

In all stages of its history dung has been susceptible to loss, the loss falling most heavily on its constituents of highest manurial value. The two main sources of loss are volatilisation and liquid drainage from the byre or manure heap. Nitrogen in the urine in the form of urea being readily turned into carbonate of ammonia, this change means escape through the atmosphere, a circumstances which can be readily detected in stables. The better the dung is consolidated the less is the loss through volatilisation. Exposure of the dung heap to rain and drainage from the roofs of buildings are other sources of wastage of nitrogen and potash, and likewise, when the dung heap is not compressed, the process of combustion—although such manure gave a false increase in phosphoric acid—is another source of loss. Covered courts and covered feeding yards are the most perfect methods of keeping dung. By such methods the valuable constituents are far better preserved than in open heaps with the manure thrown on in haphazard manner, and where it lies exposed to air, rain, and frequently the water from the roofs of buildings.

As a comparison between the two systems, experiments have shown that under the latter half the nitrogen and half the potash can be lost, while any gain in phosphoric acid is more lost through shrinkage in weight. As regards the non-volatile constituents, the highest percentages are found in dung of uniform quality. There is no greater variation in these as regards the quality of straw consumed by stock, but dung in process of rotting tends to become poorer in non-volatile constituents. The difference between rich and poor dung, however, lies in the retaining or allowing to escape the volatile soluble materials.

In an effort to estimate the cash value of farmyard manure, Professor Hendrick, of the Aberdeen and North Scotland Agricultural College, points out that comparison of the excreta and urine of different farm animals shows how much more valuable urine is in nitrogen and potash, whereas phosphoric acid is almost entirely retained in the dung. The small percentage of nitrogen present is insoluble or slow acting, resembling the nitrogen in horn, shoddy, or wool, whereas nitrogen in urine is quite as valuable as nitrogen in sulphate of ammonia. Therefore, a higher value must be placed upon it, and similarly on the potash contained in the urine. Again, the influence of the food on the quantity and quality of dung and urine has to be taken into account. If an animal gets more water than is required, the excess is excreted in the form of diluted urine. Experiments have proved that a 9 cwt. bullock getting 119 lb. turnips and 9½ lb. straw daily, excreted 58 lb. urine containing .22 per cent. nitrogen, as contrasted with 15¼ lb. urine containing .58 per cent. nitrogen when the animals received half that quantity of turnips, 13 lb. straw, and 3 lb. linseed cake. Turnips fed in large quantities tend to increase the urine and reduce its quality. In regard to solids excreted, by far the larger percentage comes from the amount of straw consumed, experiments showing that from 6 lb. to 8 lb. straw supplied as much as 30 lb. or 40 lb. fæces, as excreted by a dairy cow.

Professor Hendrick estimated that 1 ton of good average quality dung is worth 8s. to 9s. per ton, while dung of inferior quality may be valued at 5s. to 6s. per ton.

Farm Horse Breeding.

From a paper read by Mr. M. F. O'Brien, of Kyancutta, at a conference of the Eyre's Peninsula Branch of the Agricultural Bureau of South Australia.

At the present time well-bred horses are bringing good prices, due, no doubt, to the curtailment of breeding a few years ago when tractors were taking the place of horses on so many farms. A large number of farmers who were previously using tractors have now turned their attention to breeding horses, as breeding is the most economical way of obtaining a really good team. Most farmers are breeding one or two foals each year to replace aged horses on their farms, while others are breeding more than they require, and these surplus horses will be placed on the market during the next few years, with the result that prices will not be maintained at their present level. It will therefore be necessary for those who are breeding horses for sale to pay special attention to the type of horse that they are breeding. A good type of farm horse will always command a fair price, while inferior and medium types will be hard to dispose of.

After selecting the best mares on the farm, be very careful in the choice of a sire. Do not breed from a horse not true to type. Many farmers breed from any sort of a colt because they can turn him in the paddock with the mares and save the trouble of looking after an entire. This method is false economy, for it costs no more to rear a good type of foal than a half-breed. It may be said that the half-breed will work as well as a good horse, but he will never look as well in the team, and it should be every farmer's desire to have as good a team as possible. Again, the medium horse will never command near the price that a good type horse will in the sale ring.

The farmer who does not keep an entire, and who patronises a travelling horse should, if he has a choice, look well into the merits of each horse travelling in his district. If you have a thick-set, nuggety mare always choose a good, tall horse, and vice versa, but remember he must be true to type, and a proved foal-getter. I prefer the Clydesdale type of horse for farm work. They usually prove to be good workers, combining strength with pace, and are exceptionally good tempered, while the mares are always good mothers.

When the foal is born catch it and paint the navel with iodine, repeating the treatment daily for three or four days or until the navel has dried up; this will often prevent navel ill. Also, see that the mare is normal and has plenty of milk. Give her a hot bran mash after foaling, continue to give liberal quantities of bran and crushed oats if she does not appear to have sufficient milk for the foal, and allow her to graze at will in a small paddock of greenfeed. Should the foal refuse or be unable to suckle it may be necessary to give an enema, but before doing so try working a little olive oil into the anus with a finger. This often gives relief to the foal and saves straining.

To wean a foal I prefer a small paddock of greenfeed. A small quantity of chaff and oats may be made available, the foal having free access to plenty of clean water. The mare must not be forgotten, and the day the foal is weaned the mother should be fed on chaff (no oats) containing 1 lb. of Epsom salts, and be given only small quantities of water for a day or two. It is best to keep the mare working as this will help to dry her off. Should the udder become swollen and hard rub first with olive oil, then with vinegar (three parts) and olive oil (one part), and if not working give plenty of exercise. Breed foals early, say, in July or August. At this time of the year there is usually plenty of greenfeed for the mares, and the foals when older will shed their coats earlier, and usually look better than a late foal. To breed early foals and wean them at, say, six months, it is essential that a small paddock of lucerne be available.

Colt foals should be castrated in spring at about 14 months. It is best to obtain the services of a veterinary surgeon, if one is available, but the operation may be successfully performed by any competent stockman. The three main points to remember are:—First, see that the emasculators have been sterilised; second, rope the colt securely and throw him on a patch of green grass—not in the stable or yard where there is any sign of stable manure; and third, use plenty of disinfectant.

The colt or filly can be broken in at two years by giving it a few short yokes in the cultivator or harrows when working back the fallow. This should harden the shoulders, and if worked during the harvest they will not be so likely to scald. Do not work a two-year-old more than four or five hours a day in a stripper or harvester if the weather is very hot.

It is advisable to put them in a wagon when wheat carting to teach them to pull, but do not overload, and do not expect a horse to do a full day's work or pull his full share of a load until he is at least three years old. If you treat a horse well while it is young you will be amply repaid by the extra service it will give when it is older.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Friesian Cattle Society, production charts for which were compiled for the month of January, 1935 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Red Roan 4th of Blacklands	A. Pickels, Wondai	11,747·15	410·22	Premier of Hillview
Lady May 2nd of Merlin (269 days)	A. Pickels, Wondai	11,775·11	384·973	Limelight of Greyleigh
Charm III. of Bri Bri	A. E. Vohland, Aubigny	8,366·95	383·661	Gay Boy of Tryonne Villa
Duchess 2nd of Alvaglen	G. H. Knowles, Nanango	10,747·35	381·168	Cashier of Greyleigh
Eileen of Bellwood	S. J. Currant, Gunalda	8,720·05	370·982	Triumph of Oakvale
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Evelyn of Alfavale	W. H. Thompson, Nanango	15,239·8	660·362	Reward of Fairfield
Charm II. of Blacklands	A. M. Johnson, Gracemere	10,274·7	448·377	Red Prince of Blacklands
Glenore Gentle (269 days)	A. M. Johnson, Gracemere	9,330·45	376·291	Starlight of Sherwood
Blacklands Miss Minnie 2nd	A. M. Johnson, Gracemere	9,207·75	375·387	Red Prince of Blacklands
Rosenthal Pendant 5th	R. V. Littleton, Crow's Nest	8,643·7	346·472	Rosenthal Surplus
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Model 3rd of Alfavale (271 days)	W. H. Thompson, Nanango	10,964·47	501·438	Reward of Fairfield
Navillus Olive	C. O'Sullivan, East Greenmount	10,727·99	420·806	Midgets Sheik of Westbrook
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Navillus Violet	C. O'Sullivan, East Greenmount	7,925·75	322·864	Sunrise III. of Rosenthal
Rhodesview Daly 5th	W. Gierke and Sons, Helidon	7,923·86	298·357	Birdwood of Rhodesview

Senior, 2 Years (over 2½ Years), Standard 270 lb.				
Honey 8th of Sunnyside (365 days)	P. Moore, Wooroolin	10,415·35	414·776	Bruce of Avone
Ashdale Duchess 4th (271 days)	A. Frank, Boonah	9,236·9	375·401	Diamond of Greyleigh
Foremost 5th of Blacklands (268 days)	A. Pickels, Wondai	7,183·15	324·438	Fussy's Monarch of Hillview
Home Hill Alice (269 days)	A. O. Althouse, Cloyna	7,810·44	298·528	Duchess Jellicoe of Fairfield
Rhodesview Tiny 6th	W. Gierke and Sons, Helidon	7,529·47	289·982	Colonel Rose of Rosenthal
Glenroy Jemima	W. F. Kajewski, Glencoe	7,893·77	287·465	Glenroy Kitchener
Junior, 2 Years (under 2½ Years), Standard 230 lb.				
Navillus Vision	C. O'Sullivan, East Greenmount	8,427·78	333·981	Midgets Sheik of Westbrook
Navillus Daisy II.	E. W. Jackson, Nobby	8,135·81	306·914	Midgets Sheik of Westbrook
Rhodesview Nancy 10th	W. Gierke and Sons, Helidon	5,899·62	262·878	Rhodesview Red Knight
Arley Speck 3rd	B. J. Nothling, Maleny	6,560·25	259·847	Greyleigh Syntax
Montcairn Charmaine	A. E. Vohland, Aubigny	5,888·45	243·513	Dandy of Wilga Vale
FRIESIAN.				
Mature Cow (over 5 Years), Standard 350 lb.				
Ryfield Pansy 3rd (265 days)	P. Wason, Kingaroy	12,964·25	453·297	Bell De Koh Ongam (Imp.)
Junior, 2 Years (under 2½ Years), Standard 230 lb.				
Flagstone Pansy 2nd	P. Wason, Kingaroy	8,514·35	302·85	Mooroombin Colanthea
JERSEY.				
Mature Cow (over 5 Years), Standard 350 lb.				
Trinity Skylight	F. P. Fowler and Sons, Biggenden	10,198·75	604·288	Lord Ettrey of Banyule
Lyndhurst Marella	J. B. Keys, Gowrie Little Plains	9,753·79	567·15	Mercedes Noble King of Ogilvie
Bellefaire Claire De Lune	J. B. Keys, Gowrie Little Plains	9,971·49	544·893	Masterpiece Yeribie of Bruce Vale
Fauvic Rejoice	H. Cochrane, Kin Kin	6,823·1	419·396	Yingara King
Kelvinside Alice Arabella	J. and R. Williams, Crawford	7,542·5	407·631	Benedictines Perfection of Kelvinside
Trecarne Rosette	T. A. Petherick, Lockyer	6,882·6	355·773	Carnation Royal Scot
Junior, 3 Years (under 3½ Years), Standard 270 lb.				
Blossom of Linwood	F. W. Kath, Ellesmere	7,453·85	373·51	Aerofoil of Banyule
College Peggy	Queensland Agricultural High School and College, Gatton	6,066·45	286·192	Burnside Renown

Production Recording—*continued.*

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	JERSEY—continued.			
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Glenview Sultan's Majesty	F. P. Fowler and Sons, Biggenden	7,579·05	397·567	Trinity Officer
Glenview Successor	F. P. Fowler and Sons, Biggenden	6,150·75	364·302	Trinity Officer
Glenview Miss Scott	F. P. Fowler and Sons, Biggenden	5,923·0	352·126	Trinity Officer
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Woodside Xenia	J. and R. Williams, Crawford	5,755·5	323·028	Rochettes Volunteer
Jesters Pet of Glenmore	J. and R. Williams, Crawford	5,062·95	273·136	Wheatlands Jester
Bellgarth Maderia 2nd	D. R. Hutton, Cunningham	4,536·06	253·802	Bellefaire's Blondes Bellringer
Glenmah Victors Duchess	F. A. Maher, Indooroopilly	5,543·9	244·503	Retfords Victors Noble
Heather of Wattleview	E. G. Groves, Kandanga	4,226·1	237·753	Prince Royal of Wattleview

Crown Land for Selection.

DAIRYING AND MIXED FARMING COUNTRY.

INNISFAIL DISTRICT.

On 3rd April next, thirty-two portion in the Clump Point district are to be made available for perpetual lease selection in areas ranging from 174 to 390 acres, and at capital values ranging from 16s. 8d. to £1 12s. 6d. per acre. Situated from 2 to 8 miles from El Arish Railway Station, which is 4 miles from Silkwood Butter Factory, the land comprises mostly tropical scrub with fair to good soils, interspersed with patches of forest. Permanently watered throughout.

On 2nd May next, fifty-three portions in the East Palmerston district are also to be made available in areas from 152 to 258 acres, and at capital values ranging from £1 10s. to £3 per acre. Situated from 16 to 22 miles from Innisfail, and from 1 to 7 miles from Nerada Railway Station. The nearest butter factory is at Silkwood, which is only 16 miles by rail from Innisfail. All dense tropical scrub with rich volcanic soil, permanently watered by numerous creeks and watercourses.

Applicants for these lands will be required to show that they have dairy farm experience and capital. Approved applicants wishing to inspect will be granted half-fare concession tickets on Queensland railways. Inspection fares paid by successful applicants will be refunded after selection.

Applications will be received at Land Office, Innisfail, and Lands Department, Brisbane, up to 3rd April for Clump Point lands, and 2nd May for East Palmerston lands.

Plans and particulars obtainable at Lands Department, Brisbane; Land Office, Innisfail; and Tourist Bureaux, Brisbane, Sydney, and Melbourne.

GRAZING HOMESTEAD SELECTION.

HUGHENDEN DISTRICT.

109,620 Acres of Sheep Land.

Parts of Maxwelton, Cambridge Downs, and Richmond Downs Resumptions.

The undermentioned lands will be open for Grazing Homestead Selection at the Court House, Richmond, on the 11th April, 1935:—

Portions 6 and 9, parish of Anstey, comprising the southern part of Maxwelton holding, situated about 20 miles south of Maxwelton Railway Station, areas 26,304 acres and 26,967 acres. Annual rents, 2¼d. per acre and 2d. per acre respectively for the first seven years.

Portion 8, parish of Kenmac, comprising the eastern part of Cambridge Downs holding, situated about 12 miles north of Richmond, area 23,409 acres. Annual rent, 2¾d. per acre for the first seven years.

Portion 1, parish of Doncaster, comprising the north-western part of Richmond Downs holding, situated about 28 miles north-east of Richmond. Area, 32,940 acres. Annual rent, 1¾d. per acre for the first seven years.

The term of lease in each case is twenty-eight years.

The provisional valuation of the improvements on the portions ranges from £834 to £971.

Each selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years.

The whole of the portions comprise open undulating downs well grassed in normal seasons with Mitchell, Flinders, blue, and barley grasses. Each portion is watered by a bore and drains.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, and the Land Agents, Hughenden and Richmond, and the Government Intelligence and Tourist Bureaux, Sydney and Melbourne.

THE FIREBRAND.

The commonest mistake in putting on a firebrand is making it too deep. For horses it is best to rub the hair down smoothly with olive oil or castor oil—fat will do, though not so well. Then apply the brand as hot as possible, just sufficiently to feel it bite the skin. For cattle a little firmer pressure is desirable, but it is well to remember that the better bred the animal the less pressure required.

CARE OF THE SAW.

Saws are the hardest tools for the amateur to keep in good order. Leave two or three of the teeth nearest the handle of a new saw always untouched; they never come into actual use, and if left intact provide a certain guide as to how the other teeth should be kept.

WATERPROOFING BOOTS.

One pint linseed oil, ¼ pint oil of turpentine, ¼ lb. beeswax, ¼ lb. pitch. Melt ingredients by standing tin container in boiling water away from a fire, renewing hot water till all are blended. The vapour is inflammable. When dissolved pour the liquid into a tin to set. When required for use melt a small quantity and rub well into the soles of the shoes.

Or: Melt in a tin over a low flame 1 pint boiled linseed oil, ½ lb. mutton suet, 6 oz. clean beeswax, and 4 oz. resin. See that boots are dry and clean, and give a plentiful dressing; it must be put on warm with a soft brush. The leather will become quite pliant and resist all moisture.

Or: Rub a lump of wax on the boots or shoes till they become a grey colour, then heat a piece of old linen or soft calico in the oven and smooth over with the hot rag till the leather has absorbed the wax. Allow the shoes to cool, then give a good brushing and apply a good boot polish.

IDENTIFYING THE POISON BOTTLE.

A sure way to avoid mistaking a poison bottle for another is to push two ordinary pins crossways through the top part of the cork at right angles, with the points projecting. That identifies the bottle even in the dark.

Answers to Correspondents.

BOTANY.

Replies selected from the outward mail of the Government Botanist, Mr. Cyril White, F.L.S.

Shell Flower. Bindweed.

J.L.E. (Woodhill, Beaudesert Line)—

1. The plant with the green, bell-shaped flower is the Shell Flower or Moluccа Balm (*Moluccella lævis*), a native of Western Europe commonly cultivated in gardens as a curiosity. On parts of the Darling Downs it has become quite naturalised, but nowhere, we should say, has established itself as a dangerous weed.

2. The plant with underground runners bore neither flowers nor seeds, but it is evidently the Bindweed (*Convolvulus arvensis*). This weed has become increasingly common on the Darling Downs during the last four or five years, but this is the first case we have had of its growing outside that district. It is quite common in some of the Southern States. It is one of the worst weed pests so far introduced owing to its habit of producing a large number of underground running roots. Any part of these roots which is cut by a fork or plough forms a new plant. If the patch is only a small one it is probably better not to disturb the ground but to cut the young shoots and green portions down as they appear. If this is done regularly for a time the underground parts will become exhausted. A weak arsenical solution poured into the patch could be tried, and with this type of plant we think it is better, generally speaking, to use a large quantity of weak solution than a small quantity of strong. If it is decided to fork the plants out, care should be taken that the underground roots are not carried about and dropped here and there. As with Nut Grass, in small patches where it can be applied a covering of dry waste salt at the rate of ½ to 1 lb. per square foot has been found to be effective. This method is only applicable in large fields where a patch of barren ground does not matter, because the salt would render the land barren for a season or two.

Red Clover.

J.M. (Brisbane)—

The specimens represent the Red Clover, *Trifolium pratense*, a perennial species that seems to have come into favour in Queensland during the past few years, as I have seen and heard of several good plants of it. Under Queensland conditions it would probably be a short-lived perennial, lasting two, or perhaps three years at the most, although grazing might prolong the life of the plant. So far as we have observed, it does not seem altogether suitable for pasture conditions here, but is preferable for growing in small areas, either by itself or mixed with winter grasses for periodical grazing off. When grazed by itself it is very apt to cause bloat, and for this reason the mixing of it with grasses is to be preferred.

A Species of Yam.

F.McD. (Toowoomba)—

It is sometimes difficult to name plants from single leaves only, especially without any reference to the habit of growth, but the one you sent is a species of *Dioscorea*, probably *D. bulbifera, Var. suavoir*, a species of yam known as the Otaheite Potato. It is grown in Queensland purely as an ornamental vine. It dies down in the winter months, but bulbs or bulbils are borne in the axils of the leaves, and young plants grow from these. The question is often asked whether these tubers are edible or not, and we asked a leading authority on yams about the question once, and he told us that it was very difficult to say whether they were or not. As a general rule, if they were cut and went brown quickly, it was a sign that they were unfit for human consumption, and if in doubt the safest way was to cook and taste discreetly.

Chalta Tree. Osage Orange.

S.E.S. (Cairns)—

1. *Dillenia indica*, the Chalta Tree. A small, very handsome tree, with large white flowers, followed by large globular fruits. It is a native of India, and in that country the fruits are said to be used in curries and chutneys. Though I have seen the tree in cultivation in different parts of Queensland, I have never known anybody here use the fruit.
2. *Maclura pomifera*, Osage Orange. A native of North America, and largely planted in the Middle-West of the United States for hedges. It is grown in some parts of Australia, but on the whole, so far as I have observed, prefers a rather drier and colder climate to that of the Atherton Tableland. The fruits, though perhaps attractive looking, are inedible, and the plant does not belong to the citrus family, but to the Moracae family.

Plants Identified.

F.C.C. (Pittsworth)—

1. *Hibiscus trionum*, the Bladder Ketmia. A very common weed in parts of the Darling Downs and Central Queensland. Very common in the pastures. Belongs to a family not known to possess any poisonous qualities. This is probably the gooseberry-like plant mentioned by you.
2. *Cucumis* sp., probably *Cucumis myriocarpus*, the Gooseberry Cucumber, or Paddy Melon. The juicy pulp of the fruit is poisonous, due to a resinous body—myriocarpin. Bicarbonate of soda is the recognised antidote for cucumis poisoning.
3. *Neptunia gracilis*, the Sensitive Plant. A very common pasture herb and good fodder, and not known to be poisonous or harmful in any way.
4. *Atriplex semibaccata*, Salt Weed or Creeping Salt Bush. Same remarks apply as to No. 3.
5. *Anagallis arvensis*, the Pimpernel. A poisonous weed very common in cultivated areas in Queensland. Rarely eaten by stock in sufficient quantity to cause trouble, but some years ago we received seeds of this plant which have been taken in great quantity from the stomach of a cow. There are two forms in Queensland—one with red and the other with blue flowers. The properties are the same.
6. *Euphorbia drummondii*, Caustic creeper. A very common weed in parts of Queensland, and generally regarded as poisonous. Experienced stockowners always give the chief symptom as a marked swelling of the head and neck. When pierced this swelling exudes an amber-coloured fluid, and the life of the animal may be saved. Travelling stock seem to be most affected by the weed.
7. No flowers or seeds, but seems to be *Lithospermum arvense*, the Corn Gormwell, a common European weed abundant on farms in the Darling Downs. It is not known to possess any poisonous or harmful properties.

In forwarding specimens for identification and report, it is always advisable to number each specimen and retain a duplicate similarly numbered, or notes corresponding to your numbers, when names and reports can be returned accordingly.

A Beautiful Native Tree (*Ganophyllum falcatum*).

D. (Carmila, N. C. Line)—

Your specimen is *Ganophyllum falcatum*, a native of coastal Queensland, extending through New Guinea and the Malayan Archipelago to the Philippine Islands. We have not heard a local name given to it here, although it is moderately common in some parts of the Queensland coast, including some of the Islands of the Whitsunday Passage. In the Philippines it is known as *Arangen*, and, according to Dr. W. H. Brown, Chief of the Bureau of Science, Manila, the seeds of this species yield a solid fat used by some of the natives of the Philippines for illumination. The seeds are crushed and then boiled, when the oil floats on the surface. The bark, when shredded and soaked in water, yields a froth, and is said to be used in some places on this account as a substitute for soap. The berries are not known to be poisonous in any way, and we should say the tree was well worth planting as an ornamental one. The cultivation of some of these beautiful native trees is certainly to be encouraged.

Mitchell Grass.

H.M.R. (Reedley, Fresno County, California, U.S.A.)—

In reply I might state that there are four distinct kinds of Mitchell Grass in Queensland. They all belong to the genus *Astrebla*. The commonest, and, I think, the most valuable, is *Astreble lappacea* (synonym), *Astrebla triticoides*). Seed of this, and of another one, *Astrebla pectinata*, can usually be obtained from Messrs. A. Yates and Co., Ltd., Sussex street, Sydney, at 7s. 6d. per pound. The seed is very light, and I should think a pound would be quite sufficient for trial purposes for you. In your country it would probably be best sown about April, when it should ripen in August or September. The grass is not usually sown, but occurs annually in the pasture, and is mostly grazed. Sometimes it is made into hay, and is excellent for the purpose.

Asthma Plant.

G.R.P. (Brisbane)—

The specimen represents *Euphorbia pilulifera*, the Asthma Plant, a very common weed in Queensland and widely spread over the tropical and sub-tropical regions of the world. It certainly in many cases gives relief from asthma, and is not known to possess any poisonous or harmful properties. The usual method of preparation is to dry the harb in a shed or other shady place, turning it over occasionally so that it does not mildew, and making in the form of ordinary tea, about the same strength, and a wineglassful is a dose. The usual method, I think, is to let it get cold before drinking.

A Species of Native Cherry. Hoya.

S. (Townsville)—

The specimen of fruit is *Eugenia Tierneyana*, a special of Native Cherry or Lilly-pilly, common along creeks and rivers in North Queensland. Most of the Native Cherries or Lilly-pillies can be used for jam making, although we have not known anybody use the present one. When we do not know definitely the qualities of the fruit, we rather hesitate to recommend them for use, owing to one member of the family, the Finger Cherry, being so very poisonous, causing, as you know, permanent blindness, to those people who eat it. The wax-like leaf is *Hoya Nicholsonæ*, the North Queensland Hoya or Wax Flower, a common climber in some of the scrubs or rain forests of North Queensland, well worthy of cultivation, and easily propagated from cuttings.

Lantana.

P.J.W. (Samarai, Papua)—

The specimens represent a form of *Lantana Camara*, a common "Lantana" that is such a common weed pest in Queensland. The specimens were very withered when they reached me, but seem to be of the dark-red flowering forms, and these, on the whole, are not such a pest as the common form, in which the flowers come out yellow and turn to pink or lilac. Since the introduction of the Lantana Seed Fly into Queensland, the spread of Lantana certainly, we think, does seem on the decrease, although, of course, it is still a very serious pest in many places.

Coffee Senna.

W.W. (Proserpine)—

The specimen represents *Cassia occidentalis*, the Caffee Senna, a native of tropical America, now common as naturalised weeds in most tropical and sub-tropical countries. It is very common in coastal Queensland. As it and another member of the genus *Cassia* have been accused of poisoning stock from time to time in Queensland, experiments were carried out with it at the Animal Health Station, Yeerongpilly, some years ago, and it was shown to purge cattle, but to have no other ill effects. This is what one would expect, as the plant belongs to the same genus as the shrubs which produce the senna leaves of commerce. The name "Coffee Senna" refers to the fact that the seeds have been reported to be used as a substitute or adulteration for ordinary coffee.

General Notes.

Staff Changes and Appointments.

Mr. G. W. Ashford, of Gympie, has been appointed an Inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock, and will be stationed at the Murarrie Bacon Factory.

Mr. A. R. Betts, Inspector of Stock, has been transferred from Murarrie to Upper Pilton.

The following have been appointed canegrowers' representatives on the undermentioned local sugar cane prices boards:—

Messrs. W. G. Merrill and F. W. Valentine, Cattle Creek Local Board; W. D. Davies and W. C. Ah Shay, Goondi Local Board; and T. F. Ross, North Eton Local Board.

Mr. C. Blake, Wamuran, has been appointed an Honorary Inspector under the Diseases in Plants Acts.

Mr. L. C. Vallence, Assistant to Analyst, has been appointed Analyst, Government Chemical Laboratory, Department of Agriculture and Stock.

Mr. J. M. Martin, of Kangaroo Point, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act. A similar appointment has been given to the Forest Ranger at Cardwell, Mr. G. S. R. Gentry. Honorary Rangers under the Animals and Birds Acts have been appointed in the Bundaberg district,—namely Messrs. J. C. Twyford (Avoca), J. Dittmann (Branyan), and C. G. H. A. Bock (Branyan road, Bundaberg).

Mr. J. W. Moy, Temporary Inspector, has been appointed an Inspector on probation under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts.

Plywood and Veneer Levy

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts, empowering the Plywood and Veneer Board to make a levy on all pine plywood and veneer delivered between the 23rd February, and the 2nd May, 1935, in pursuance of an order allocated by the Plywood and Veneer Board. The levy shall be used to provide for the administrative expenses of the Plywood and Veneer Board, and shall be at the following rates:—

(*a*) On plywood three-sixteenths of an inch or less in thickness and on veneer three-sixteenths of an inch in thickness at the rate of 2½d. per 100 feet face measurement.

(*b*) On plywood or veneer of a greater thickness than three-sixteenths of an inch and on veneer of a thickness less than three-sixteenths of an inch at the rate per 100 feet face measurement which bears the same proportion to 2½d. as the thickness of the plywood or veneer bears to three-sixteenths of an inch.

Dairy Products Stabilisation Act.

Executive approval has been given to the issue of an Order in Council further amending the Dairy Products Stabilisation Act, and a Regulation to provide for the expenses of members of the Dairy Products Stabilisation Board.

The amendments to the Act include the alteration of the definition of "quota." The definition, before amendment, was the proportion of dairy products manufactured during a stated period in the State that a manufacturer is permitted to sell in the course of his intrastate trade in the State. The new definition provides that "quota" shall be the quantity of dairy products manufactured in the State which a manufacturer is permitted to sell within any stated period of time in the course of his intrastate trade in the State.

Butter, Cheese, and Plywood and Veneer Boards Extended.

Orders in Council have been issued giving notice of intention to extend the operations of the Butter, Cheese, and Plywood and Veneer Boards.

It is proposed to extend the Butter and Cheese Boards for the period from 8th February, 1935, to 30th June, 1935, and the Plywood and Veneer Board from 3rd May, 1935, to 2nd May, 1936. In each case petitions for a ballot on the question of whether or not such Boards should be continued for the periods mentioned may be lodged at the Department of Agriculture and Stock on or before 18th February next.

Poole Island a Sanctuary.

Poole Island, in Port Denison, Bowen, has been declared a sanctuary under the Animals and Birds Acts, and it will be an offence to take or kill any animal or bird on such island.

Plywood and Veneer Board's Levy.

Regulations which have been issued under the Primary Producers' Organisation and Marketing Acts empower the Plywood and Veneer Board to make a levy on pine plywood at the rate of 3d. per hundred feet face measurement, such levy to be used in establishing and maintaining a fund for the purpose of subsidising manufacturers for plywood despatched outside the Commonwealth. The levy will remain in force from the 5th February, 1935, under the expiration of the present Board on the 2nd May next, and the amount of such levy shall be paid weekly to the Board on all deliveries made by manufacturers as shown by the respective weekly returns submitted to the Board.

Provision is made in the Regulations for a ballot to be taken on the question of whether or not the levy shall be made if four or more "growers" petition the Minister for Agriculture to that effect before the 4th February, 1935. Persons eligible to vote are those who own plywood and veneer plant and have produced plywood and veneer for sale.

New Bags for Imported Potatoes.

The Minister for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.) has announced that it had been decided, as from the 1st February, to enforce the regulation under the Diseases in Plants Acts providing for the use of new bags for potatoes imported from other States.

"His attention had recently been drawn," added the Minister, "to the state of the bags being used, which, in many instances, were in a deplorable condition." All the other States insisted on the use of new bags for imported potatoes, and though a similar regulation had previously been gazetted in Queensland it had never before been strictly enforced.

Live Virus Cultures—Transmission by Post.

The Postmaster-General's Department advises that it is necessary for the following conditions to be complied with in connection with the transmission by post of live virus vaccine:—

(1) Live virus vaccine must be enclosed in a thick glass container hermetically sealed. The container must be surrounded with an absorbent substance in sufficient quantity to protect it from breakage and to absorb all the liquid in the event of it being broken. The container and its protective covering must be securely packed in another container of metal, wood, strong corrugated paper or other suitable material. The outside cover must bear the name and address of the sender and an endorsement indicating the nature of the contents of the package.

(2) The distribution and use of live virus cultures are subject to the provisions of the State laws, and the responsibility for observance of those laws lies with the persons concerned in such distribution and use.

Bullamon Plains a Sanctuary.

The property of Mr. E. B. Cameron, at Thallon, known as Bullamon Plains, consisting of portion 80, parish of Bullamon, and portions 17 and 18, parish of Gerar, has been declared a sanctuary under and for the purposes of the Animals and Birds Acts, and Mr. Cameron has been appointed an Honorary Ranger under these Acts to ensure the protection of the native animal and bird life thereon.

"A.C.F." Granite Fertilizer—Error Corrected.

It is regretted that an error has occurred in the published analysis appearing in the 1934 Annual Report of the Department of Agriculture and Stock relating to "A.C.F. Granite Fertilizer."

The correct figures are as follows:—

	Guarantee. Per cent.	Found. Per cent.
Nitrogen, as ammonium sulphate	4	4.1
Phosphoric acid, water-soluble	12	12.0
Potash, as potassium sulphate	10	10.2

From the above it will be observed that the fertilizer in question is in accordance with the guarantee.

Rural Topics.

Horse-shoeing—Points Affecting the Animal's Welfare.

The increase which was taking place in the use of horses made it desirable to direct attention to certain points which, although well known to horsemen before the trend from animal to mechanical locomotion, were now in danger of being forgotten, observed the Chief Veterinary Surgeon of the New South Wales Department of Agriculture in a recent wireless address. On the observance of these points depended the welfare of the horse and very frequently the safety of the rider.

The shoeing of horses in order to protect their feet against damage when working on hard roads was a practice of great antiquity, but it was not until well on in the nineteenth century that it was reduced to really sound principles based on the conservation of the horse's foot and the prevention of injury. During the eighteenth century, an essentially artificial age, there had come into use certain practices—such as paring out the sole of the horse's foot until it was so thin that it could be made to bend on the pressure of the fingers, cutting away of the frog, and rasping of the whole outside of the wall to make the foot appear pretty, which were quite contrary to the design of the animal's anatomy. Indeed, the inculcation of proper methods had not been so much a question of seeing that things were done but that things were left alone.

It was well to remember in dealing with the foot that whilst the outside was a hard horny case, it contained very sensitive structures, and that if bruising or damage to these soft structures occurred, the results were far more serious than would be the case if these sensitive tissues were not enclosed in the hard horny case which was the hoof. In the case of an injury to soft tissues on other parts of the body, there was room for inflammatory reaction to take place, for swelling to occur, for fluid to be poured out around the injured part without subjecting the tissues to very severe pressure; but if any of these changes took place in the soft structures enclosed in the hoof, there was no room for expansion, the pressure was very severe indeed, caused considerable pain and naturally was accompanied by lameness.

The hoof, therefore, required to be left as far as possible in its natural state. The frog should not be mutilated, the bars must be left as strong as possible, the sole should be no more touched than was necessary to remove loose flakes of horn, and the wall should be left intact, no rasping being allowed above the clinches. It was, of course, often necessary to rasp the lower part of the foot in order to shape the hoof, but even this should be reduced to a minimum. A foot so treated would, unless disease was present, have a thick strong wall, which would not be unduly damaged by the nails, and would have a large and healthy frog capable of bearing concussion without injury to the animal's legs and strong enough to keep the heels open. The sole would be tough and would act as a guard against bruising or other injury.

The surface which was to bear the shoe should be flat and even and the shoe surface which was to meet this wall surface should also be flat and even. If either the under surface of the wall or the shoe was concave where they met in apposition, then pressure would not be evenly distributed over the wall and that portion of the wall which was receiving pressure would be liable to break away from the rest.

What was known as "springing the heels" was often indulged in and in this case, while lowering the wall of the heel by having a flat surface on the shoe, a space was left between the shoe and the hoof at the heels. When the horse put his foot to the ground pressure caused this space to be obliterated, but that only followed because an undue strain was placed on the wall. If the wall was to be maintained as strong as possible it should meet the shoe evenly when at rest, and no space should be possible between the shoe and the bare surface of the foot.

Shoes if left on the hoof too long were very apt to cause damage, and it was sometimes thought that if a horse had only been carrying out light work on easy roads and the shoe was not worn, there was no necessity to remove it, but as the hoof was continually growing the relative position of the shoe on the hoof changed. If too long an interval occurred between removals of the shoe then the position of the heel of the shoe would shift from the wall on to the space between the wall and the bar. It would sink inside the wall and press on what was known as the "seat of corn." The result of this pressure would be a bruising of the sole and consequent lameness.

If such a shoe was removed and the horn was examined it would be found after the dirty top layer had been removed, that the horn below was blood-stained or black. This change had been brought about by pressure and a rupture of small blood vessels. As previously pointed out, any damage to the softer tissues inside the horny box was very painful because wherever such damage occurred swelling followed and inside the hoof there was no room for swelling without causing considerable damage to the tissues generally. Therefore, the horse's shoe should always be watched and removed for refitting, if reshoeing was not necessary, every four or five weeks.

Water Movements in Soil—Effects of Cultivation.

The value of water is impressed upon every farmer as a result of his experience. A congenial rainfall invigorates and increases his crop, whereas a period of drought may make his labours abortive. The cultivable soil is supplied with water from three sources; from the clouds, as rain or snow; from the air by absorption, as water vapour; or by condensation, as dew, and from the lower layers of the soil or subsoil by capillarity or "creeping." Artificial methods are adopted where the supply of water is insufficient.

Plants take up an enormous quantity of water—someone has estimated that a crop of oats uses up 400 tons—the greater part of which passes through the pores of their leaves as water vapour into the atmosphere. Evaporation is always taking place, and in hot, dry weather the surface soil becomes exhausted of water, and so shallow-rooted crops are liable to suffer. In windy weather the land dries up very rapidly, as evaporation is increased, owing to the immediate removal of the vapour from the surface of the soil by the agitation of the air.

Drainage has for its object the removal of surface and surplus water, thus enabling the soil to admit air and to keep up a circulation of water in the interstices. Waterlogged soil is useless for crops; independently of drainage, providing the subsoil is porous, the water will sink or creep downwards by capillarity and gravitation. In the case of an impervious subsoil a water table is formed, and the depth at which it occurs is a very important matter for the farmer to ascertain. If near the surface a water table is a source of trouble, as its presence leads to the decline of deep-rooted plants, and, moreover, the loss of water by evaporation may, at a critical time, completely exhaust the supply.

Nature ordains that the soil will store up water during the winter for the use of plants in the spring. Modern cultivation, having for its object the growth of heavy crops, including grass, necessarily entails some provision for the retention of water in the soil. Particles of rocks, earthy materials, and organic or vegetable substances, of which the soil is chiefly composed, are all concerned in the distribution of water. The vegetable fragments absorb large quantities of water, while the rocky and earthy particles retain it by clinging or surface tension. Each particle becomes wrapped, as it were, in a cloak of water of varying thickness. The thickness of the cloak depends upon the water supply, and when a very low limit has been reached the covering gradually disappears owing to capillarity absorption by rootlets and evaporation. A certain quantity of water, however, always surrounds the small fragments in the soil, and when the minimum is reached plants can no longer by their use make use of it, their power of absorption being weaker than the surface tension or clinging force of the particles.

Suppose a farmer takes a big clod in his hand and breaks it up into a dozen smaller ones, he can readily see that the latter will require a much larger amoount of water to cover their surfaces than the original mass. Hence, it is obvious that one means of conserving water in the soil is through cultivation, by which a fine tilth is produced. If one has the draught power, summer cultivation is always the best, especially on clay lands.

As already stated, the soil stores up water during winter. If ploughing is postponed until the early spring the soil not only contains less water, but the water lost during the operation is considerable. Evaporation takes place at considerable depths in the soil, depending largely on the air present, and as the surface temperature in spring is less than that below, the vapour as it rises is condensed, and so a moist surface is the result. In summer the reverse is the case, the surface temperature is the greater, and a dry condition is produced. Too much vegetable matter, as in peat soils, is objectionable, and so are too fine particles; but, if a soil is not naturally clayey, no amount of cultivation will render it so. A good soil is, in reality, a composite; it needs to have enough clay and humus to hold water, and to draw the water to the surface for plant roots when overground drought conditions require it; enough humus and clay to provide food for plants, and enough sand to make it porous, warm, and easily worked.—"The New Zealand Farmer."

Value of Lime in Pasture Making.

The value of lime in pasture making and pasture improvement is becoming more and more apparent as time goes on. Recent experiments carried out by Mr. Robert Laird, West of Scotland College organiser for Ayrshire, are described in an issue of the "North British Agriculturist" just to hand. A special grass seed mixture was sown with the idea of having one year's hay and several years' pasture. As a result of those experiments, it has been concluded that the hay yield was affected less by the composition of seed mixtures than by a number of other factors, the chief of which was the presence, or absence, of a sufficient supply of lime to assist the useful grasses and clovers in establishing themselves. The difference due to this factor was 50 per cent., as opposed to a maximum of 9 per cent. between the seed mixtures.

Points in Dairy Economy.

In a recent survey of milk production in the South-east of England, Mr. James Wyllie makes several important points with regard to dairying economy. For instance, he has a firm belief in the value of roots, especially mangolds, for milch cows (in opposition to some lately expressed opinions) and holds that if mangolds can be grown at a cost 12s. per ton, they form one of the cheapest, as well as one of the best of winter foods. Again, the production of high-quality grass and hay is of the first importance both in economy of feeding and in milk yield.

It is quite as important to reduce feeding costs as to increase milk yield, and the economic balance which gets the best results in the latter from the lowest cost of the former is a point which is only attained by experience.

Again, the most economic size for the herd for milk purposes has often been debated. Mr. Wyllie says that if the cows are to be fed mainly on purchased cakes and meals, a small herd of heavy milkers may be more economical than a large herd of moderate milkers. But if the chief foods are to be grass, hay, and roots a large herd of moderate milkers may yield better net results.

The question of labour costs is also an important one and on the average family farm financial difficulty often begins when extra labour has to be brought in and paid for. The keeping of reliable records of milk production and feeding costs is essential in order to attain the accurate figure to be placed opposite the value of the milk yield. Of course, the farmer—even the smallest—has to be something of a bookkeeper nowadays, in order to keep going, but undoubtedly a closer system, especially in connection with dairy farming, would help him materially.

Wireless Talks to Farmers.

Tuesday, 12th March, 1935—"Winter Pastures," by C. W. Winders, B.Sc. (Agric.).

Thursday, 14th March, 1935—"Grape Culture," by H. Barnes, Director of Fruit Culture.

Tuesday, 19th March, 1935—"Some Remarks on Animal Nutrition," Part I., by E. H. Gurney, Agricultural Chemist.

Thursday, 21st March, 1935—"Some Remarks on Animal Nutrition," Part II., by E. H. Gurney, Agricultural Chemist.

Tuesday, 26th March, 1935—"Observations on Tobacco Fertilizer Trials," by W. J. Cartmill, B.Sc.

Thursday, 28th March, 1935—"Expanding our Export Trade," by J. F. F. Reid, Editor of Publications.

Our Forest Heritage.

A sorry story of lack of foresight in the management of the mountain country of south-east New South Wales and of eastern Victoria was disclosed during the discussion on soil erosion at the Science Congress in Melbourne last month. Indiscriminate timber cutting and uncontrolled grazing, with concomitant bush fires, have greatly depreciated the value of important catchment areas, and completely ruined fertile valleys. Streams have become rushing torrents in time of rains, causing land slides and carrying silt that will, before many years, go a long way towards filling with mud the water storage and irrigation works constructed at such great expense. Mr. A. S. Kenyon, late of the Victorian State Rivers and Water Supply Commission, described the position as heart breaking, and out of the wideness of his experience was able to suggest a line of action which, he hoped, would

check the destruction. This embodies the appointment of an independent board, representative of forest, water, agricultural, and grazing interests, to control the upper catchments of streams. Mr. Kenyon expressed a belief at the congress that under reasonable control forest products could be removed without affecting the water supply to any extent. He was, however, strongly opposed to grazing in any form. The cow, he said, eats the green shoots, lets air into the forest, and ruins the forest cover. There will, probably, be some difference of opinion on the latter points, but nobody can argue seriously against the necessity for taking early action to protect mountain catchments. Only a few days ago the Prime Minister announced that the Cabinet had approved of a grant of £331,000 to the States for the encouragement of afforestation. New South Wales' share will be £50,000, and Victoria's £100,000, and it is expected that the State Governments will supplement the Federal contribution on a £1 for £1 basis. Naturally the whole of the amount will not be expended on the eastern watersheds, but it is the expressed intention of Victoria to spend some of the grant on the establishment of forest camps for youths. Thanks to the generosity of two Melbourne business men, an experimental camp was started in Gippsland, Victoria, some time back. It has done really excellent work in training youths in the management of forest areas, and it is reasonable to believe that similar camps scattered throughout the heavily timbered country would do a power of good.—"The Pastoral Review."

Soil Losses.

Our apathetic attitude towards soil losses, caused by wind and rain, was also referred to at the Science Congress. As Associate-professor G. L. Wood, who opened the question said, it is a matter for wonder that in a country so far committed to policies of State regulation, and where public utilities have been brought under public ownership to such an extent, that supervision of the greatest utility of all—the soil—should have been overlooked. There is abundant evidence that the care and protection of soil throughout Australia are inadequate, and the time has come when we must recognise that many of the activities connected with land utilisation should be re-examined from the viewpoint of their effects on soils beds in particular and on national economy in general. He added that "it is only when the disastrous results, such as gullying and increased frequency and severity of the floods are revealed, that attention is directed for a time to the reality of the peril. In a continent where rural industries are the basis of national wealth, and in which there is such a marked deficiency of water supply over such wide areas, it is difficult to understond this continued neglect by the authorities." We realise that the New South Wales Government has set up an Erosion Committee, and offers advice through its official publications in connection with checking erosion under given circumstances. Little or nothing appears to have been done in other States, however, and it is to be hoped that the strictures of scientists will awake Governments to some sense of responsibility. It is admitted that comprehensive plans to prevent soil losses in toto may not be easy to devise. It may be impossible to find a complete cure, but much can be done if the problem is attacked from the right angle. It is generally acknowledged that the removal of timber, scrub, and even pasture cover is a common cause of erosion with light sandy country. A partial solution there seems to lie in the direction of preventing further settlement of such lands without proper safeguards in the matter of wind breaks.—"The Pastoral Review."

The Stockman is an Artist.

If the cows were standard machines, like mass-produced cars, the treatment and feeding of them could be standardised, but no real stockman can ever forget the individuality of the animals he looks after. Each cow in a long byre will have its own peculiarities quite well known to the stockman. The two great indications every true stockman looks for are, firstly, the bloom on the coat, and, secondly, the state of the dung. A cow in good yield should never be hard in her droppings, and although this is true and a certain looseness is desirable, anything like real scour should be investigated at once and the cause removed and the feeding adjusted. It is occasionally necessary, if the cow has been pushed just a trifle too hard, to cut her concentrates out for a day and give her bran mashes, and bring her back to her full ration by degrees. Whatever general principles may be laid down by pundits, the real stockman will always remember that it is his job to adjust the broad general principles of feeding and management to a multitude of individual peculiarities in his charges. That is what makes a stockman's job such an interesting one.—H. E. Shand in "The Farmer and Stock-Breeder."

Be Careful with Arsenic.

At an inquest at Wagga (New South Wales) recently the Coroner found that a man had died from arsenic poisoning accidentally self-administered. The evidence disclosed that the man had been engaged dipping sheep on Brewarrina Station. Without washing and with portion of his clothing saturated with the sheep dip, he took his afternoon tea, sitting on a drum of sheep dip which had some of the dip on the top of it. The assumption was that some of his food came in contact with the poison, for half an hour later he complained of sickness and collapsed. He was admitted to Wagga Hospital but died three days later.

Horse and Tractor Cultivation Compared.

The different kinds of implements used in soil cultivation have all developed from a pointed stick whose function was to stir and break up the soil. Cultivators and harrows are in the direct line of descent from the pointed stick; the plough represents a divergence from the line, in that its purpose is to invert the soil rather than to stir it. The extremes of plough design are the sod or grassland plough which turns over an almost unbroken ribbon of soil, and the digger-breasted plough, common in continental areas, which turns over a rough broken furrow with the maximum of disruption and mixing.

Before the advent of the tractor, the design of cultivation implements and their methods of use had evolved subject to two basic considerations: a supply of cheap and abundant labour, and a forward speed of 2-2½ m.p.h. which suited the natural walk of both horse and man.

At first the tractor had little effect on these considerations—it was regarded as a more powerful haulage agent than horses, and, therefore, suitable for heavy jobs, such as stubble-breaking and deep ploughing. With further experience, and with the better designs of the tools for the lighter forms of cultivation, the scope of the tractor rapidly increased. The addition of such improvements as the power take-off and the development of power-operated implements for the hay crop opened up additional uses for the tractor as a farm tool. There is little doubt that a steady increase has taken place in the number of hours' work per year put in by the tractor on the average farm. Periodical censuses carried out by the Agricultural Economics Research Institute, Oxford, on farms employing both tractors and horses show that the hours of work of the tractor per year on all jobs are about half those put in by the horse. There is undoubtedly room for this figure to be appreciably increased; the general introduction of rubber tyres may help here.

But, desirable in many ways though this increase may be, it must be remembered that the outstanding advantage of the tractor is its ability to deal quickly with urgent work. Farming cannot be done to a rigid time-table; the weather is the controlling factor. In unfavourable seasons the farmer may be unable to work his soil when he wishes. He must produce a suitable tilth before he sows, and for this he may be compelled to wait so long that his crop, when sown at last, is almost certain to suffer in yield.

It is in such conditions, and in the preparation of land for the next crop, immediately after the current one is harvested, that the tractor finds a most useful avenue of employment. Similarly, in preparing the soil for spring-sown crops, the inevitable rush of work in the few fine spells in a wet spring can be tackled with some hope of success.

The economic value of this reserve of power, especially to the farmer on heavy land, is incontrovertible. The tractor enables him to cut costs directly, but even more important is the indirect cost-cutting, through the ability to get work completed in unfavourable spells. No costings system can show the money value of indirect savings, for obvious reasons, but no farmers would dispute their importance.

Agricultural economists have made numerous comparisons of tractor and horse costings on the farm. In common with all agricultural costing data, they present difficulties which do not arise in other industries. Take as a simple example the cost of keeping a horse. It will be fed, wholly or partly, on food grown on the farm. What figure should be assigned to this food? It should be less than the market price of the foodstuff, but to what extent? It is not even possible to state the exact cost incurred by the farmer in growing his food, since the yield is controlled, to a degree not precisely known, by the residual value of the manures applied to the preceding crops.

Some conventions must therefore be adopted, on which agricultural economists have not yet arrived at complete agreement. But, in spite of these inherent difficulties, direct comparisons of horse and tractor costings are capable of showing in what way the tractor can achieve a direct saving as compared with horse-power.

Some typical results are given in the following table, which has been constructed from figures supplied by agricultural economists. The figures, which are some years old, apply to individual farms employing both horses and tractors, and this partly accounts for the wide variations in costs for the same work. For our present purpose, however, this does not matter:—

Cost per Acre for Horse and Tractor—Wages Included.

Ploughing:
Horse, 20s., 19s. 10d., 14s. 10d., 17s. 2d.
Tractor, 15s. 9d., 14s. 6d., 11s. 11d., 8s.

Cultivating:
Horse, 2s. 6d., 4s.
Tractor, 3s. 6d., 4s. 5d.

Harrowing:
Horse, 1s. 6d.
Tractor, 3s. 6d.

Rolling:
Horse, 1s. 6d.
Tractor, 2s. 1d.

Harvest:
Horse, 2s. 7d., 2s. 8d., 2s. 1d.
Tractor, 3s. 11d., 3s. 6d., 4s. 7¼d.

The salient feature of the table is that on all these farms tractor ploughing is cheaper than horse ploughing, while in all the other operations the reverse is the case. The explanation is simply that in ploughing the tractor is given a full load, while in the other operations it is working below its capacity. The practical implication is, therefore, that all tractor cultivation tools should be designed to give a full load like the plough. The modern tractor cultivator already does this, but there is still scope for the farmer to use gangs of harrows to increase the resistance for this naturally light type of cultivation.

The above results have an important bearing on the question of complete mechanisation of arable farming. Here it should presumably be easier to design the equipment and to operate it so that a full load is always given, although in most parts of the country extensive and perhaps costly alterations in the field boundaries would be needed.—From a paper on "Functions of Mechanical Power in Soil Cultivation," read at the Institution of Automobile Engineers by Dr. B. A. Keen, Assistant Director Rothamsted Experimental Station.

Better Agriculture—Philosophy of "Good Enough."

Surveying the general field of Australian agricultural education, Professor J. K. Murray (Q.), in his presidential address to the agricultural section of the Science Congress in Melbourne, deplored the fact that of all the young men about to enter grazing or farming in any one year in any one State of the Commonwealth, considerably less than 100 would have passed through a full State Agricultural College course. An outstanding feature of modern life, he said, was that, despite the spectacular successes of research, communities spent on research only a small fraction of the money willingly voted for war or defence. The Council for Scientific and Industrial Research, the Waite Research Institute, the Glenfield Veterinary Research Station and others had produced results which indicated that agricultural research in the aggregate paid in hard cash. The agricultural colleges, developed apart from University faculties and from State colleges, had been in being for many years before the first Australian faculty of agriculture was founded. They were not to remain entirely apart, however; at the founding of the Queensland University, for instance, provision was made in the status for the affiliation of the State Agricultural College. It was a very definite and easily-argued premise that sound steps in the solution of an agricultural problem depended on an adequate statement and investigation of it. Notable requirements were an adequate pasture research organisation for tropical and sub-tropical dairying conditions, for cattle and sheep conditions generally, and a dairy research institute for the elucidation of problems in production and manufacture not elsewhere satisfactorily handled. Satisfaction with a production figure of 160 lb. per cow lactation, with cheddar as practically our only cheese, and with low percentage figures of choicest in our export butter and cheese bespoke either a "good enough" philosophy, or a lack of knowledge how to do better, or a sound attitude in accordance with the economic facts of the situation.

PLATE 133.—A QUEENSLAND FARM HOMESTEAD.

PLATE 134.—PASTURE, WOODLAND, AND MOUNTAIN RANGE.
A scene in the Fassifern Valley, Queensland.

Plate 135.—Forested Slopes and Fertile Farm Land in the Fassifern Valley.

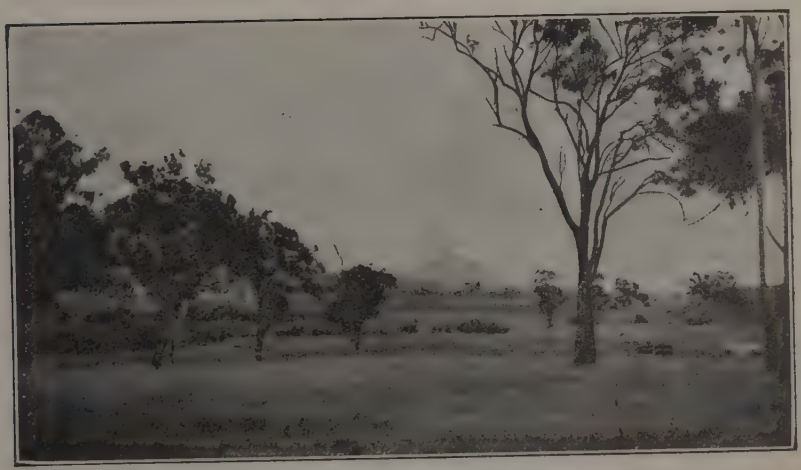

Plate 136.—The Charm of the Fassifern Countryside.
Rich arable and pasture lands on Coochin Coochin.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

THE TEETH OF OUR PEOPLE A NATIONAL DISGRACE.

The Extent of the Evil.

IN Sydney last August a combined meeting of medical men and dentists debated at length the causes of our bad teeth. On two points there was universal agreement. Firstly, as to the extent and importance of this evil. It was agreed that from 90 to 95 per cent. of our children have imperfect teeth, and that after childhood some diseases of the teeth is almost universal. Its bad effects on general health were recognised by all present. One medical authority was quoted as having stated that 20 per cent. of all chronic diseases were due directly or indirectly to the teeth. Another had traced over twenty-eight systemic diseases to the same cause.

Faulty Diet is the Cause.

It was also agreed by all that the condition of our teeth is caused by what we put into our mouths. In other words, it is the result of the foods consumed by civilised peoples. To find perfect teeth nowadays we must search out primitive races living on primitive diets, and even these are beginning to be hard to find. It is interesting to know that in the Eskimo language there is no word for toothache, and that the Maoris living under native conditions had almost perfect teeth. But when primitive races take to civilised diets their teeth rapidly become as bad as ours.

Differences of Opinion.

As to the exact method by which our civilised diet destroys our teeth there was much difference of opinion. Most of the speakers had each his own theory. Not content with advocating this, each considered it necessary to discredit every other theory. At first reading this is very confusing; but a little reflection makes it appear probable that the true explanation is more complex than many allow, and that the inability to admit more than one mode of causation is a human weakness that we should do well to avoid.

Two diseases are recognised. Firstly, the decay of teeth, or dental caries, which is most prevalent in childhood, but extends throughout life; and, secondly, a disease of the tooth-sockets known by the ugly and often misused term pyorrhœa. The latter is a disease of adult life, though its early beginnings may be traced in childhood. As our space is limited we will deal only with the former. For this three main explanations, with some differences of detail, were offered.

Weakly Built Teeth.

Careful research has recently shown that a very large percentage of both temporary and permanent teeth are of poor structure and

imperfectly calcified. There can be no doubt that such teeth will decay more easily than strong well-formed teeth. When such teeth emerge with fissures or pits, they are actually inviting caries. The liability of a tooth to destruction depends largely on its structure. To make good teeth an abundant supply of Vitamin D and a sufficiency of calcium and phosphorous are needed, more particularly when the diet consists largely of cereals (bread, flour, oatmeal). These necessities are supplied by milk, butter, cheese, eggs, liver, and green vegetables. The diet of the expectant mother is usually deficient in milk and green vegetables. For the infant and young child the addition of cod liver oil is recommended. On such a diet even caries that has already commenced may sometimes be arrested.

We cannot agree with those who see no other cause than this. Even though teeth are weak and easily destroyed, there must be some exciting cause. Even the weakest bridge does not break down until it bears some load, and a flawed cricket bat will not split until it hits a ball. There must be some further cause for caries besides structural defects.

Poorly Developed Jaws from Want of Use.

Great importance is placed by some on the use of the jaws by the developing child. Soft pappy foods so popular with mothers do not provide this exercise. A limb which is disused does not develop properly, and the same is true of the jaws. If the jaws are underdeveloped the teeth are overcrowded and underdeveloped also. What the child needs is plenty of hard, dry, crisp food.

Though too much weight may be attached to this factor, we agree that it is of real importance.

Erosion of the Teeth by Acids.

Acid fruit juices are harmless, for they excite a flow of saliva by which the acids are neutralised. Indeed, they exert a beneficial cleansing effect. The dangerous foods are soft and well-cooked starches, or sugar and starch given in such a way as to produce a sticky mass, for instance, chocolate, sticky sweets, sweet cakes and biscuits. Even bread may be harmful. All of these undergo an acid fermentation and cause decay in any tooth area protected from natural cleansing by lips and tongue, that is, in fissures and pits in the teeth, and in interstices between the teeth. Here we have a cause increasingly prevalent in modern diets. Cheap, satisfying, tasteful, backed up by great commercial interests these tooth-destroying foods have an irresistible appeal to those who "eat what they like."

The Moral.

Let expectant mothers take plenty of good fresh milk and green vegetables. Let all babies be breast-fed wherever possible. Let those artificially fed have some cod liver oil. Let every child take a pint of milk daily. Give your children more potatoes and less bread. Especially do not give them bread between meals. After all meals containing bread see that their teeth are well cleaned. Cut out all chocolates, sticky sweets, and biscuits made out of finely ground flour. Give children hard crisp food instead of pap and mush, and don't be afraid of letting them use their teeth. Foods that are good for children are good for mothers also, and if mothers will eat them they will have no difficulty in getting their children to do so.

IN THE FARM KITCHEN.

ART IN BOILING AN EGG.

Thus Janet L. Rankin, in "Eggs," a publication devoted to the Poultry Industry:—Appetising, nourishing, quickly and easily prepared, eggs in their simpler forms are, she states, amongst our most valuable foods. Like milk, they are a tissue-building food, and, if properly cooked, contain all the vitamins in their most easily digested form. So many recipes go wrong because the method, rather than the recipe, is at fault; so it would be as well first to understand how to treat eggs for the different functions for which you intend them.

There is one definite rule I would give you which applies in all cases: Never cook eggs at a high temperature. Eggs begin to set (or coagulate) at 170 degrees to 176 degrees F. Water does not boil until it reaches 212 degrees F., so when an egg is placed in merrily bubbling water it is being subjected to nearly 50 degrees more heat than it needs, and it is, consequently, far tougher and less easily digested than it ought to be.

The very expression, "boiled egg," should never have come into being, for no egg ever should be boiled. The best way to "cook" an egg in its shell is to put it on in cold water, and when it comes to the boil remove from the heat and leave it for one, two, or three minutes, according to whether soft or medium cooked eggs are liked. This will give a delicate, tender texture.

A poached egg, as a rule, is not subjected to such fiery treatment, for, if it were left over great heat, the albumen would soon break up and harden and boil over the sides of the pan, as if in protest.

So, while this low temperature principle is in your mind, we will go right on to the important summer function of the egg, when it acts as a thickening agent. What can equal the smooth, velvety thickness of a well-made egg custard, and it is so simple if the eggs are properly treated. The other day a town friend said to me: "I always use custard powder, as my egg custards always curdle." She put the accent on "curdle" as if it were the fault of the eggs, poor things, so I explained my golden rule: "Never cook eggs at too high a temperature"—and now she is beating me at my own game!

There are two ways of making satisfactory custards and sauces—one is to place the saucepan over a low flame and watch it like a cat watching a mouse, stirring intelligently all the time until the mixture thickens. The other way is to use a double saucepan, also over a moderate heat. I prefer the latter, and when a double boiler is not available, I use a bowl or jar stood in a pan half full of hot water. For baked puddings, custards, and pies, which contain an important proportion of eggs, these we set in a dish or pan of warm water in the oven, just as we set the saucepan over another containing hot water.

My foundation recipe for "boiled" custard (do not forget, it should never actually boil!), one pint milk, two large eggs (or three small ones), two tablespoonfuls sugar, one-eighth teaspoonful salt. Flavouring to taste (lemon rind, vanilla, cinnamon, &c.). Scald the milk with the flavouring in the double saucepan. Beat the eggs slightly, add the sugar and salt, and then gently add the scalded milk, stirring all the time (remove any lemon rind, &c.). Return the mixture to the saucepan and stir until thick and smooth.

A very good variation of the above is made by using three large eggs instead of two, separating the yolks from the whites. Use the yolks for thickening, as in previous recipe. Whip the whites very stiffly and fold in lightly at the last. This makes a delicious spongy custard, ideal to trifles or for serving with fruit.

TOMATO RECIPES.

EACH year the prestige of the tomato as an item of food is enhanced. In America tomato-juice as a cocktail has largely supplanted the more potent variety. As soup, salad, and savoury it appears in a score of ways. The recipes given cover dishes hot and cold, simple and rich.

Tomato Souffle.

Take 1 cup tomato pulp, 1 tablespoonful butter, 2 tablespoonfuls grated cheese, 3 eggs, ½ cup breadcrumbs or crumbled granose biscuits, 1 teaspoonful made mustard, salt, and pepper. Mix together all the ingredients except the eggs and bring to the boil. When cool add the beaten egg-yolks, and lastly the egg whites beaten very stiff. Pour into a buttered dish, sprinkle with breadcrumbs and a little grated cheese, and bake in a hot oven for 15 minutes.

Tomato Savoury.

Take a number of pieces of hot buttered toast and the same number of thick slices of tomato. Dip the tomato slices in egg and cracker crumbs and fry in butter. Place on the toast, sprinkle with grated cheese and chopped capers, season with pepper and salt, and put in the oven till the cheese is browned.

Tomato Fritters.

Take 2 eggs, ½ cup self-raising flour, pinch salt and pepper, and a teaspoon of chopped parsley or sage. Make a batter with a quarter of a cup of milk, cut some tomatoes in thick slices, dip in batter, and fry to a golden brown.

Tomatoes and Peas.

Take three or four firm medium-sized tomatoes, cut them in half and scoop out some of the pulp. Season with pepper and salt and a finely-chopped onion, place in a buttered dish, and bake in the oven for about ten minutes. Prepare ¼ pint rich white sauce, add to it two beaten egg-yolks, and stir over the fire till thick. Season with pepper and salt and a pinch of chopped mint, add two cups of carefully-cooked green peas, make all thoroughly hot, and, when the tomatoes are cooked, fill with this mixture and serve.

Stuffed Tomatoes.

All sorts of tasty little odds and ends may be used for stuffing tomatoes. Use firm tomatoes, cut a slice from the top, and scoop out some of the pulp. Mix with the pulp some grated cheese and breadcrumbs, minced meat, chicken, or ham, smoked or free cooked fish, mushrooms, or celery. Flavour with pepper and salt, refill the tomatoes, sprinkle with fine breadcrumbs, and place on the top of each a small piece of butter. Bake in a moderate oven for twenty minutes.

Tomato Toast.

Take 1 ripe tomato, 1 egg, 1 oz. cooked ham, ½ oz. butter, a flavouring of onion, salt, and pepper. Peel the tomato, cut up, and mince the ham and onion. Melt the butter, add the tomato, and cook for a few minutes, stirring all the time. Take from the fire to cool slightly, add the beaten egg, stir over the fire till it thickens, and serve on hot buttered toast.

Tomatoes with Cheese Cream.

Take 3 or 4 tomatoes, 1 gill cream, 1½ oz. grated parmesan cheese, 2 tablespoonfuls aspic jelly, salt, and pepper. Cut the tomatoes in half, remove some of the pulp, and drain them. Whip the cream stiffly, season with salt and pepper, whisk in the aspic jelly, which should be liquid, but cold. Add the grated cheese, fill the tomato shells, and pipe a pretty border with a rose-pipe. Garnish with cress and serve very cold.

Stuffed Tomato Salads.

Take firm tomatoes, of uniform size (if very large, cut them in half; if small, cut a slice from the top). Scoop out some of the pulp and drain the tomato. Fill with the following fillings, or with any other savoury mixture on hand:—

(1) Pickled walnuts, new cold potatoes, chopped parsley, and mayonnaise.
(2) Chopped celery, shredded pineapple, and mayonnaise.
(3) The heart of a small cabbage finely shredded, 1 tablespoonful grated onion, and some mustard dressing.
(4) Chopped ham, mixed with aspic jelly and a little of the tomato pulp. Season well, fill the tomatoes, and set on ice.
(5) Put the pulp on the fire, add 1 teaspoonful of gelatine, and cook. Add some diced beetroot, chopped gherkins and capers, and fill the tomato-cases.

Tomato Moulds.

Peel some tomatoes and scoop out some of the pulp. Fill with chopped celery and a little mayonnaise dressing. Lime small moulds with aspic jelly, and, when set, put in each a filled tomato. Fill the moulds with aspic jelly, set on ice, and turn out on a lettuce leaf.

Tomato and Apple Salad.

Place a thick slice of tomato on a lettuce leaf. Shred some lettuce very finely and mix with mayonnaise. Place some on the top of each slice of tomato, then a tablespoonful of very finely shredded apple, mixed with a little chopped mint.

Tomato Sauce.

This sauce may be served with any meat, fish, or vegetable entrees. Take 2 oz. butter, 2 oz. flour, 1 lb. tomatoes, 1 small onion or eschalot, pinch of sugar, pepper, and salt, 1 oz. ham or bacon, ½ pint stock or water. Melt the butter in a saucepan, fry the chopped onion and ham, add the flour, brown slightly, stir in the stock or water, and bring to the boil. Add the tomatoes and cook for half an hour. Strain and season.

Tomato Relish.

Take 5 lb. tomatoes, 1½ lb. apples, 4 lb. sugar, 1 pint vinegar, ¼ oz. cinnamon bark, ¼ oz. ginger, 3 blades of mace, and a few cloves. Cook slowly till quite thick, and, when cool, bottle in jars. It is delicious for sandwiches or flavouring, and may be used with cold meat.

Tomato and Pineapple Jam.

Take 6 lb. firm tomatoes (peeled and sliced), 1 large pineapple cut into dice, 4½ lb. sugar, pinch of salt, and the juice of 3 lemons. Boil the pineapple with 1 lb. sugar until it is soft, add tomatoes and the rest of the sugar, and boil rapidly for about one hour. Add lemon-juice and salt and test on a plate to see if it will set when cool. When ready remove from the fire and bottle while still hot.—E.S., in the "Sydney Morning Herald."

Tomato Jam.

Wash and stem the tomatoes, place in cooking vessel, crush sufficient of the fruit to start boiling, and reduce the whole to pulp by boiling, say for half to three-quarters of an hour. Strain all the pulp through a ¼-inch mesh sieve and weigh. Add ¾ lb. sugar for each pound of pulp, and bring to the boil. The cooking time cannot be stated definitely, there being many influencing factors. Fast boiling for approximately an hour to an hour and a-quarter will produce the desired consistency.

As tomato jam made to this recipe is inclined to be insipid, the addition of a little acid in the form of citric or tartaric or pineapple, &c., is a decided improvement. The addition of acid should be done when the jam is about half cooked, and at the rate of 1 oz. to 25 lb. of pulp. Lemon juice may be substituted for tartaric, and if it is desired to use the whole lemons, they should be cut up into very thin slices and boiled for, say, half an hour before being added to the jam.

Apple pectin added to tomato jam has proved a decided success, supplying bulk, combination, and acid in one.

POINTS IN JAM-MAKING.

Use the best crystallised sugar.

The fruit should be sound and not too ripe.

Boil fast, as this preserves the colour and flavour.

Stir as little as possible, for stirring breaks up the fruit and renders it more liable to burn.

Make small quantities at a time; large quantities are not always a success.

Skim off impurities and do not use iron or tin preserving pans.

Use a wooden or an aluminium spoon for stirring.

Seal the jars down perfectly to keep airtight.

Store in a dry, dark pantry.

VEGETABLES AND HOW TO COOK THEM.

Vegetables, as they are ordinarily spoken of, may be classified as (1) fresh—(*a*) starchy, e.g., potatoes, parsnips; (*b*) non-starchy, e.g., cabbage, carrots, lettuce, spinach; and (2) dried—being the ripened seeds of certain plants, such as peas and beans.

Food Value of Vegetables.

The food functions of these two classes of vegetables are distinctly different. The fresh vegetables are composed chiefly of water, most of them containing over 80 per cent. of it. In so far as nutriment is concerned, they are of little value. Some of the vegetables, such as potatoes, beets, carrots, parsnips, &c., do contain a considerable quantity of starch and sugar, which produce heat and energy in the body, but it would be more economical to obtain this from other sources of food such as bread and cereals.

The fresh vegetables have specific purposes in the human diet which no other foodstuff can supply.

(1) They are one of our most valuable sources of mineral salts. These salts are mostly compounds of potash, which are most valuable anti-scorbutics or blood regulators. A deficiency of green vegetables sometimes causes eczema.

(2) Fresh vegetables supply ballast to the intestines. The cellulose or indigestible fibrous material they contain is a stimulus to the movement of the intestine; hence their special value in constipation.

The dried vegetables have a higher food value, being so rich in protein that they have been described as "the poor man's beef." The mineral matter in these vegetables is composed largely of potash and lime.

Cooking of Vegetables.

Knowing the importance of the generous use all the year round of vegetables in the diet, it is worth while considering the best methods of cooking.

Following general rules, to obtain good results in cooking fresh vegetables, it is important that they should be crisp and firm. If not taken directly from the garden, they should be crisped in cold water before cooking. Cabbage and cauliflower should be soaked for one hour in cold, salted water. When cooking vegetables, they should be put in fresh, boiling water. Use one teaspoon salt to each quart of water, but do not add until vegetables are almost done as salt tends to harden the tissues. Use only enough water to prevent burning.

Strong-smelling Vegetables.

There has been rather general belief that strong-smelling vegetables, like cabbage, onions, and cauliflower, should be closely covered and simmered or cooked just below boiling point. It has been found that these vegetables can be left uncovered and allowed to boil rapidly without leaving any noticeable odour in the room. A larger amount of water must be used than in the case of mild-flavoured vegetables. A crust of bread put into the water and cooked with the vegetables will assist in dispelling the odour. The addition of soda destroys the vitamin value and therefore should not be used.

Time of Cooking.

Vegetables should be cooked until tender, but overcooking breaks up and wastes them, and in some cases develops undesirable flavours. As soon as the vegetables are tender, they should be drained and seasoned. If the vegetable water is saved and used in making a sauce, so much more of the flavour and mineral salts are retained. This method is particularly good for young carrots, asparagus, and some of the more delicately-flavoured vegetables.

Cooking Dried Vegetables.

The important point in cooking dried vegetables—ripe peas, beans, and lentils, which are rich in protein or tissue-building material, is not to cook them at too high a temperature. The protein, which is called legumin in these plants, like the protein in egg-white or meat, is toughened by strong heat. To avoid this, they should be simmered or cooked just below boiling point. On account of the dense, tough texture of those vegetables, and the small quantity of water they contain, they should be soaked overnight to soften the cellulose and shorten the

time of cooking. The soaking also improves the flavour by dissolving out a bitter substance. It is also important that the water in which they are cooked be softened, either by adding a little baking-soda or boiling the water before it is used to get rid of the lime, as lime has a tendency to toughen the legumin. When beans are large, like lime beans, the tough outer skin is sometimes removed when it has been loosened by soaking, as the skins make the digestion difficult for some people. This difficulty is overcome where the beans are made into soup. The dried vegetables, being themselves so rich in protein, should be served as a meat substitute rather than with meat.

The general rules, then, for cooking dried vegetables, would be to wash them and soak them overnight in water softened by adding one quarter of a teaspoon of baking soda to one quart of water. In the morning, drain, rinse, and put on to cook in cold water; let come to a boil, drain, cover with boiling water, and simmer until dry.

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SPECIAL AND IMPORTANT.

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The need for the strictest economy makes any other form of reminder at present impracticable. THE ONUS OF REMEMBERING THE DATE OF EXPIRY OF, AND RENEWING THE SUBSCRIPTION PROMPTLY IS, THEREFORE, PLACED ON EACH SUBSCRIBER.

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Instead of just sending the annual subscription—one shilling—along, it is suggested that, when renewing, they do so for two or three years, or even a longer term. For instance, FIVE SHILLINGS would keep a name on our subscribers' register for FIVE YEARS.

By doing this subscribers would help greatly in reducing clerical labour, as well as avoid the inconvenience to themselves of posting annually the very small sum necessary for their registration.

Readers renewing their subscriptions should USE THE ORDER FORM on another page, which should be filled in FULLY and CORRECTLY. Renewals by letter do not as a rule give the essential information, thereby causing unnecessary waste of time and much inconvenience. The Form is also our record, and orders which come by letter require special handling to adapt them to our card recording system.

When an address on the Order Form is not that to which the Journal has hitherto been sent, attention should be called to the new address, and the former address given. This assists us to identify subscribers, of whom we have many of the same name, often in the same district, as well as in different parts of the State.

Women subscribers should add to their names the word "Mrs." or "Miss," as the case may be. This is a constantly recurring omission, and its correction causes a lot of unnecessary labour in checking electoral rolls and other references. Wives and children of subscribers should apply in the subscriber's name, and so facilitate registration.

Orchard Notes for April.

THE COASTAL DISTRICTS.

IN the Orchard Notes for March the attention of citrus-growers was called to the necessity of their taking the greatest possible care in the gathering, handling, sweating, grading, and packing of the coming crop of fruit, as the returns for the labour expended in the upkeep of their orchards will depend entirely on the condition in which the fruit reaches the market. Many growers fail to realise the very important fact that the success of fruitgrowing does not depend merely on the proper working and management of the orchard, so essential for the production of a good crop of high-class fruit, but that the manner in which the fruit is handled and placed on the market is of even greater importance. In no branch of fruit culture is this more evident than in the case of citrus fruits, as no fruit pays better for the extra care and attention necessary to enable it to be marketed in the best possible condition. Every season there is more or less loss in the consignments sent to the Southern markets, the percentage depending mainly on the weather conditions, the loss in a wet year being much heavier than that in a dry year.

A very large percentage of the loss is due to what is known as blue mould—a rotting of the fruit caused by a mould fungus—and this loss can be prevented, provided necessary precautions are taken. Although this matter was dealt with last month, it is of such vital importance to our citrus-growers that it is necessary to again refer to it.

In the first place, growers must clearly understand that blue mould cannot occur on perfect fruit, the skin of which is free from injury of any kind. The fungus causing blue mould can only obtain an entry into the fruit through an injury to the skin; it will thus be seen that the remedy is to take every possible care not to injure the skin of the fruit in any way.

Few growers realise how easily the skin of citrus fruits is injured, especially that of fruit grown under moist and humid conditions, when the skin is full of moisture and so tender that the least sign of rough handling causes serious injury. The cells of the skin are so brittle that they are easily broken, and when so broken a ready means of entry for the mould fungus is provided, and blue mould follows in due course.

The remedy for blue mould is in the hands of the grower, who must learn so to gather, handle, and transport the fruit from the orchard to the packing-shed that it does not receive the slightest injury, and further, that when it has reached the packing-shed it must be carefully placed in shallow bins or on trays and be exposed to the air for at least seven days, so that the surplus moisture in the skin may be removed, and the skin thus become toughened and less easily injured. This drying of the skin is known as "sweating," and during the time the fruit is being sweated it should be kept under observation, and all fruit showing signs of blue mould or injury from fruit flies, sucking or boring insects, mechanical injury or bruising, should be removed.

In order to prevent injuring the skin when gathering, all fruit must be cut and not pulled. Gloves should be used to handle the fruit, and when cut it should be placed in padded baskets or other suitable receptacles. Any fruit that falls or is injured in any way should be rejected, as it is not fit to send to a distant market. At the same time, if the injury is only slight, it can be sent to a local market for quick sale.

For oversea and interstate markets only perfect fruit should be selected, and further, it must be graded for size, colour, and quality, and properly packed, only one grade of fruit being packed in a case. The cost of cases, freight, and marketing is now so high that only the best fruit will pay to export, and even the best fruit must be properly graded and packed in order to produce the best returns.

All orchards, vineyards, and plantations not thoroughly clean should receive immediate attention, for from now until the next rainy season the ground must be kept in a thorough state of tilth and free from weeds in order, firstly, to retain moisture in the soil, and, secondly, to enable birds, ants, and predaceous insects to get at and destroy the pupæ of fruit flies and other pests harbouring in the soil.

Banana and pineapple plantations must be put into good order, and kept free from weed growth.

Land to be planted with trees should be got ready, as, if possible, it is always advisable to allow newly-cleared land time to sweeten before planting.

Farm Notes for April.

FIELD.—Those areas already lying in fallow for subsequent sowing with wheat should be kept in good tilth, using field implements that have a stirring effect in preference to those which tend to reverse the surface soil. The surface should never be allowed to cake; consequently all showers must be followed by cultivation, as soon as conditions will permit of teams and implements working freely.

Early fodder crops, such as barley (skinless or Cape) and certain varieties of wheat may be sown during April. Growers of winter fodders will be well advised to study the article dealing with dairy fodder plots which appeared in February, 1922, Journal.

Potatoes should now be showing good growth, and must be kept free from all weed growths by means of the scuffler. If sufficiently advanced, and any doubt exists as to the prevalence of blight, advantage should be taken of fine weather to give a second spraying of Bordeaux mixture, a calm and somewhat cloudy day being chosen if possible for the spraying.

Where land has been previously well prepared, lucerne sowing should be carried out this month, and intending growers of this fodder will be well advised to ascertain the germinating qualities of seed submitted to them for purchase. The difference between a good and bad "strike" is often traceable to the poor class of seed sown.

Maize and cotton crops should now be in the harvesting stage, and, once matured, are better in the barn than the open paddock, where weevils and other insects are usually prevalent at this season of the year.

Root crops sown last month should now be making fair growth, and during the early period of such should be kept free from weeds, and where necessary thinned out. Sowings of mangels, swedes, field carrots, sugar-beet, and rape may still be made where conditions of moisture will permit.

As the sowing season is close at hand for certain varieties of wheat—i.e., those which require a fairly long period to develop in—every effort should be made to bring the seed-bed into the best possible tilth and to free it from foreign growths of all kinds. The grading of all seed-wheat is strongly recommended, and growers who favour certain varieties should adopt a system of seed selection from prolific strains with a view to the raising of larger quantities of pure typical grain for ultimately sowing in their larger fields.

Pickling of wheat to prevent smut (bunt) is necessary. Germination tests should be carried out prior to commencing seeding operations.

Sorghums which have matured and are not immediately required as green fodder should, wherever possible, be conserved as ensilage to provide for a reserve, to tide over the period when grasses and herbage are dry. Succulent fodder of this description is the best possible form of insurance against drought, and for maintaining dairy and other stock in thrifty condition.

HOW MANY TURNS TO THE ACRE?

A man driving a team ought to know what distance he must travel with a given width of machine to cover an acre. It can be ascertained by dividing the width of cut of machine in feet into 660. Thus a 6-feet harvester travels 110 chains to do an acre, a 10-feet machine 66 chains, and so on.

TO UNREEL BARBED WIRE.

Run an iron rod through the roll of wire and over each end of the rod slip a small jam tin with a hole in the centre of the bottom. Then loop a trace chain over the end of the rod at each side and attach a swingle-bar to the middle of the chain. The free end of the wire is fastened to a post and a horse hooked to the swingle-bar on the wire and the roll pulled along. The wire not only comes out straight, but most of the slack is taken up and there is very little straining to do.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JANUARY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1935, AND 1934, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Jan.,	No. of Years' Records.	Jan., 1935.	Jan., 1934.		Jan.,	No. of Years' Records.	Jan., 1935.	Jan., 1934.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	12·30	34	5·04	22·09	Clermont	5·15	64	2·40	1·78
Cairns	16·91	53	5·58	23·72	Gindie	3·73	36	..	0·08
Cardwell	17·25	63	2·36	46·17	Springsure ..	4·20	66	4·49	0·29
Cooktown	14·58	59	10·82	16·03					
Herberton	9·78	49	6·34	18·66					
Ingham	16·05	43	3·61	31·23					
Innisfail	20·69	54	7·10	35·60					
Mossman Mill ..	18·15	22	18·97	33·75	*Darling Downs.*				
Townsville	11·16	64	2·76	13·87					
Central Coast.					Dalby	3·26	65	7·02	2·13
					Emu Vale ..	3·21	39	3·05	3·89
					Hermitage ..	3·26	29	..	3·67
Ayr	11·19	48	0·93	9·60	Jimbour	3·49	47	3·84	1·56
Bowen	10·15	64	2·37	8·06	Miles	3·63	50	5·23	3·77
Charters Towers ..	5·51	53	3·02	6·93	Stanthorpe	3·58	62	4·00	4·06
Mackay	14·33	64	4·34	5·38	Toowoomba ..	5·08	63	3·34	5·42
Proserpine	16·01	32	7·04	7·75	Warwick	3·56	70	2·50	3·90
St. Lawrence ..	9·34	64	5·58	0·87					
South Coast.									
Biggenden	5·26	36	3·15	0·39	*Maranoa.*				
Bundaberg	8·82	52	2·97	1·28					
Brisbane	6·44	84	5·75	3·26	Roma	3·09	61	2·76	0·55
Caboolture	7·65	48	5·96	4·34					
Childers	7·51	40	4·81	1·28					
Crohamhurst ..	12·53	42	7·45	9·21					
Esk	5·71	48	6·18	4·83					
Gayndah	4·63	64	2·24	0·52					
Gympie	6·66	65	3·74	3·24	*State Farms, &c.*				
Kilkivan	5·55	56	4·44	2·79					
Maryborough ..	7·21	64	4·66	2·44	Bungeworgorai ..	1·78	21	2·76	0·54
Nambour	9·76	39	6·67	4·98	Gatton College ..	4·30	36	3·73	4·54
Nanango	4·64	53	5·78	2·14	Kairi	9·87	21	2·42	20·82
Rockhampton ..	7·74	64	4·11	1·77	Mackay Sugar Experiment Station	14·32	38	3·75	5·01
Woodford	7·86	48	5·23	5·75					

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JANUARY, 1935.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·72	91	72	104	17	67	7	1,145	12
Herberton	..	85	66	92	17	60	13	634	12
Rockhampton	29·79	92	73	98	1	68	21	411	5
Brisbane	29·84	87	69	95	1	61	7	575	10
Darling Downs.									
Dalby	29·82	88	64	94	27	53	7	702	8
Stanthorpe	..	82	58	90	27	44	7	400	8
Toowoomba	..	83	62	92	27	49	6	334	10
Mid-Interior.									
Georgetown	29·74	97	75	104	1	69	7, 29	530	9
Longreach	29·72	104	75	112	1	60	7	112	1
Mitchell	29·77	95	67	104	28	50	7	105	5
Western.									
Burketown	29·71	95	79	104	1	70	19	1,537	7
Boulia	29·71	103	77	112	12	65	7	112	6
Thargomindah	29·76	99	74	109	12	62	6, 7	30	1

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	March. 1935.		April. 1935.		MOONRISE. Mar., 1935.	Apr., 1935.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	5·45	6·25	6·2	5·50	12·56	3·9
2	5·45	6·24	6·3	5·49	2·2	4·17
3	5·46	6·23	6·3	5·48	3·12	5·23
4	5·46	6·21	6·4	5·46	4·22	6·29
5	5·47	6·20	6·4	5·45	5·31	7·34
6	5·48	6·19	6·5	5·44	6·37	8·41
7	5·48	6·18	6·5	5·43	7·44	9·45
8	5·49	6·17	6·6	5·42	8·51	10·45
9	5·50	6·16	6·6	5·41	9·57	11·39
						p.m.
10	5·51	6·15	6·7	5·40	11·1	12·27
11	5·51	6·13	6·7	5·39	12 noon	1·11
					p.m.	
12	5·52	6·12	6·8	5·38	12·57	1·48
13	5·52	6·11	6·8	5·37	1·47	2·20
14	5·53	6·10	6·9	5·36	2·38	2·51
15	5·54	6·9	6·9	5·35	3·15	3·18
16	5·54	6·8	6·9	5·35	3·49	3·48
17	5·55	6·7	6·10	5·34	4·21	4·18
18	5·55	6·6	6·10	5·33	4·48	4·48
19	5·56	6·5	6·11	5·32	5·17	5·24
20	5·56	6·4	6·11	5·31	5·47	6·5
21	5·57	6·3	6·12	5·30	6·19	6·51
22	5·57	6·2	6·12	5·29	6·51	7·44
23	5·58	6·1	6·13	5·28	7·25	8·40
24	5·58	6·0	6·14	5·26	8·5	9·42
25	5·59	5.59	6·14	5·25	8·53	10·46
26	5·59	5·58	6·15	5·24	9·47	11·53
27	6·0	5·57	6·15	5·24	10·46	a.m.
28	6·0	5·55	6·16	5·23	11·48	12·57
29	6·1	5·54	6·16	5·22	a.m.	2·2
30	6·1	5 53	6·17	5·21	12·54	3·5
31	6·2	5·52			2·4	

Phases of the Moon, Occultations, &c.

5 March	●	New Moon	12	40 p.m.
12 „	☾	First Quarter	10	30 a.m.
20 „	○	Full Moon	3	31 p.m.
28 „	☽	Last Quarter	6	51 a.m.

Perigee, 4th March, at 9.54 p.m.
Apogee, 17th March, at 2.36 p.m.

Neptune, on the 4th, will be in opposition to the Sun, rising as the Sun sets. Its distance from the Earth, about 2,885 million miles, makes this huge planet invisible to the naked eye, but with a telescope it will be in a favourable position to be picked up later in the evening if sufficient time and patience are used to select it from some small stars in the hind leg of the Lion.

Jupiter, apparently near the eastern border of Libra (Right Ascension 15.25), will become stationary on the 10th, then appear to move westward till it reaches a degree north of the brightest star, Alpha Libri, on 14th July. On the 15th Mercury will be at its greatest elongation, 28 degrees west of the Sun. As the Sun will reach the first point of Aries about midnight on the 21st, and the Equinox will then occur, every observer who keeps a careful note of the place on the horizon at which the Sun rises will have his east point most exactly. By noting the point where the Sun sets on the 21st or 22nd, he will be able to draw a line, say 10 or 12 feet in length, pointing exactly east and west from which his meridian, or south to north line, can be drawn at right angles. With the use of a plumb-line, it would then be possible to see when the shadow of it agrees with the Meridian, at what time it is really mid-day.

The planets Venus and Uranus will be within half a degree of one another, and will be well placed above the western horizon for an observer with telescope or binoculars, about half-an-hour after sunset on the 22nd. The part of the sky in which they will be situated is just about where Aries, Pisces, and Cetus meet. A little later Mercury will be somewhat nearer apparently to Saturn, but both will set 1 hour 12 minutes before the Sun. At 3 a.m. on the 25th, when Jupiter is on the meridian, it will be 6 degrees (length of Cross) north of the gibbous Moon.

Mercury rises at 4.12 a.m. on the 1st, and at 3.38 a.m. on the 15th.

Venus sets at 7.38 p.m. on the 1st, and at 7.28 p.m. on the 15th.

Mars rises at 8.38 p.m. on the 1st and at 7.41 p.m. on the 15th.

Jupiter rises at 10.5 p.m. on the 1st, and at 9.10 p.m. on the 15th.

3 April	●	New Moon	10	11 p.m
11 „	☾	First Quarter	3	42 a.m.
19 „	○	Full Moon	7	10 a.m.
26 „	☽	Last Quarter	2	20 p.m.

Perigee, 2nd April, at 6.12 a.m.
Apogee, 14th April, at 5.48 a.m.
Perigee, 30th April, at 2.0 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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